Report to the California Toll Bridge Authority

Covering Preliminary Studies

for an

Additional Bridge Between San Francisco and the East Bay Metropolitan Area

Calif.

BY DEPARTMENT OF PUBLIC WORKS

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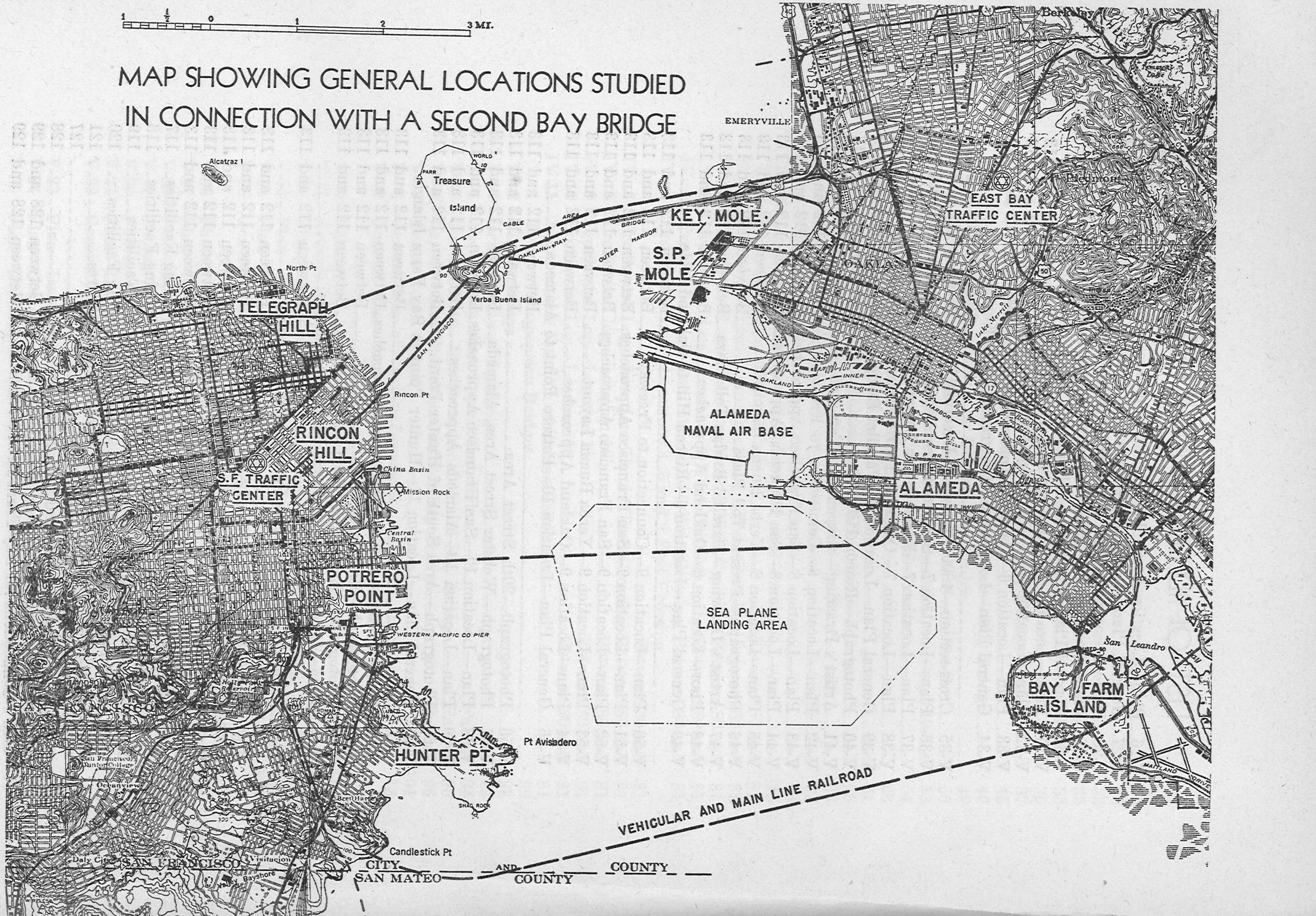
MAP SHOWING GENERAL LOCATIONS STUDIED IN CONNECTION WITH A SECOND BAY BRIDGE



Second Bay Bridge Study

SCOPE

The extent of the investigation as authorized depended in part on provisions of the California Toll Bridge Authority Act of 1929 and subsequent amendments (Appendix D), setting forth the policy of the State with respect to toll bridges and defining the powers of the Authority.

The policy of the State as expressed in Section 1 of the act is "to acquire and own all toll bridges situated upon or along any part of the highways of the State."

Section 4 of the act implies a general meaning of a "toll bridge" when it states:

> The * * * Authority shall authorize and direct the Department of Public Works to build toll bridges and other toll highway crossings * * * across waters, bays, arms of bays, straits, rivers and streams in California, both navigable and unnavigable * * * whenever in its opinion and in the opinion of the Department of Public Works it is necessary and desirable so to do * * *.

Accordingly, it was judged within the scope of the report to consider tube and causeway crossings. Further, the statutory limitation of location to "any part of the highways of the State" is not contradictory to the words of the resolution "without limitation as to location," since any new location can be enacted a State highway.

Section 5 determines the responsibility of the department in presenting its opinion:

> Whenever the Department of Public Works determines that it is for the best interests of the public highways in the State that a new toll bridge or bridges or other highway crossings be constructed * * * the director of said department shall submit his recommendation to the * * * Authority, together with preliminary estimates of the cost * * * and * * * of the amount * * * to be raised * * * by * * * bonds, and a statement of the probable amount * * * to be contributed from other sources * * *.

Accordingly such estimates are made a part of this report. The magnitude of the undertaking, the diversity of construction items, the large proportion of the cost to be expended for foundations, and the irregular trend of prices for materials and labor required studies in detail of geologic and economic factors before reliable estimates could be compiled.

Section 5 limits the security for bonds to tolls and other revenues received from the operation of the facility. Neither principal nor interest may be an obligation of the State. Consequently, the Authority and this study are concerned only with a transbay highway crossing that is self-liquidating, and that with such certainty as to attract investors to purchase the revenue bonds.

There is no real limitation of scope in Section 12, which forbids the construction of another crossing within 10 miles of the San Francisco-Oakland Bay Bridge as long as its bonds are outstanding and unpaid. The Act stated that this provision was contractual for the benefit of bond holders. It will not prevent construction at any location if the bond holders are secured in some other way. Therefore, the scope of the study will not be limited to this provision.

Summarizing, the scope of the study and report embraces the following:

(1) Study of the need for an additional transbay highway crossing to relieve congestion on the existing San Francisco-Oakland Bay Bridge.

(2) Engineering investigation of feasibility and cost of alternative locations for such an additional transbay highway crossing.

(3) Review of advantages and disadvantages of each such alternative from the viewpoints of national defense, coordination with existing or potential terminal highway systems, interference with navigation by water or air, and of other vested interests.

(4) Economic comparison of feasible alternative locations and types of construction.

(5) Study of legal and financial requirements for each or any such alternative location.

(6) Recommendation of definite location, type, construction period, financial plan, and preparation for an additional transbay highway crossing best suited to the combination of engineering, legal, and economic requirements.

PROCEDURE

The work was done by a special Bay Bridge studies organization, under the general supervision of C. H. Purcell, Director of Public Works and Chief Engineer of the San Francisco-Oakland Bay Bridge, and under

the immediate direction of F. W. Panhorst, Bridge Engineer of the California Division of Highways. The personnel of the organization is shown in Appendix H.

The investigation had three phases. First was the detailed study of traffic volumes and capacity of the existing bridge to determine need for an additional crossing. At the same time, a general study was made of alternative locations, the factors to be analyzed in a comparison, and the availability of pertinent data. Plans were laid for the other phases of the work.

Following a decision on need, the second phase was one of survey and research to collect data already available and secure other necessary information. These included (1) origin and destination of transbay traffic, (2) available and potential terminal distributive highways and streets, (3) foundation materials available at the alternative locations, (4) advantages, disadvantages, and indirect costs of alternative locations, (5) unit costs probably effective during the construction period, and (6) general designs suitable for development of each location. The foundation study included borings by contract.

The final phase was that of analysis and detailed study of the assembled information. Designs for practicable locations were defined in sufficient detail to assure reliable estimates. Immediate approach structures were laid out to determine their costs. Careful investigation was made of the economy of providing facilities for interurban and for steam railways. Effectiveness and cost of the better locations were compared for determination of the best solution to the problem.

SPECIAL STUDIES UNDERTAKEN

Fact finding was divided into a series of special studies. Details of these studies appear in later sections of the report and summaries of the findings will be given in the following section. The subjects and scope of the special studies were:

(1) Traffic Studies (Section III). Analysis of transbay traffic and corrective statistics in order to estimate future traffic and determine urgency of an additional crossing; segregation of traffic to determine facilities needed for automobiles, trucks, buses, and interurban trains; origin and destination study to determine diversion of future traffic from the existing bridge to each alternative location; investigation of steam-rail crossing proposals and factors bearing on design of facilities and economy.

(2) Foundation Studies (Section IV). Review of previous explorations and comparison with construction experience; obtaining additional borings as required for determining feasibility and cost of alternative locations.

(3) Design and Cost Studies (Section V). Preparing design standards and tentative design layouts; studying the trend of construction costs to deter a sound basis for engineer's estimates; determi relative economy of optional designs at each loca estimating costs of optimum designs and appr connections as a basis for economic and fina studies.

(4) Financial Studies (Section VI). Esti ing future revenues; calculating future opera costs; preparation of amortization plans.

SOURCES OF INFORMATION

Many agencies and firms were very helpful in assembly of the required data. Formal reports were made available are listed in the reference Bibl raphy (Appendix I), and the use of much valu information compiled by the San Francisco Dep ment of Public Works and City Planning Commiss the Alameda County Committee for a Second Crossing, the San Francisco Chamber of Commerce, California Public Utilities Commission, and the E Bay Municipal Utility District is acknowledged.

The public hearing of the Joint Army-Navy Bo on the subject of an additional transbay crossing timely (August 12-15, 1946). The oral testimony been summarized (Appendix B) for reference, cop of some formal statements were obtained, and the he ing developed several sources of unpublished data. addition to matter presented to the Board by the ra roads, a great deal of factual data related to perfor ance of steam and diesel locomotives over grades a costs of operation and requirements for metropolit termini was requested and obtained from the Atchis Topeka and Santa Fe Railway, Key System, Southe Pacific Company and the Western Pacific Railro

Through the cooperation of George T. McCoy, St Highway Engineer, assistance was given by the Tra Department and San Francisco-Oakland Bay Brid Division in compiling and analyzing statistics of existing San Francisco-Oakland Bay Bridge Traf Since this structure is of such prime value as a sour of information in connection with the construction a operation of a second bridge a brief statement of history is presented.

Through the cooperation of the Joint Army-Na Board, aerial photographs were obtained of the seve principal terminal areas.

HISTORICAL BACKGROUND

The San Francisco-Oakland Bay Bridge was open to traffic November 12, 1936, ending many years controversy. Many had believed that it was econom ally unfeasible, if not physically impossible, to brid San Francisco Bay directly between population cent without impairing the great natural harbor. Objectio had been made by the Army and Navy from natio

defense viewpoints, by shipping interests, by ferry operators, and by many who considered ferries a picturesque essential of San Francisco, along with cable cars, Chinatown, and Fishermans Wharf.

Before that, the Bay had been bridged only in straits like Carquinez or shoals like San Mateo and Dumbarton. None of these bridges spanned the lanes of warships or merchant vessels en route from the Pacific to the ports of San Francisco or Oakland.

The controversy was settled by the Hoover-Young San Francisco Bay Bridge Commission. Having asked the Department of Public Works to make an engineering, economic, and traffic study of several proposed locations, it accepted and recommended approval of the Department's conclusion that a direct high-level double-deck bridge should be built from Rincon Hill via Yerba Buena Island to Key Route Mole.

Some elements of the proposal were considered daring at the time. Tower piers were to be founded on rock 240 feet below Mean Lower Low Water and burdened by 170 feet of soft material or broken rock. The bridge would be the longest structure ever erected at any considerable height, and the cost was unprecedented.

The events leading up to the final designs and awarding of contracts were:

Oct., 1929	First meeting of Hoover-Young Commission.
Aug., 1930	Commission's report published, Chapter 400, Statutes 1931 passed, providing $650,000 for preliminary surveys and plans.
Aug., 1931	C. H. Purcell appointed Chief Engineer and appoints Board of Consulting Engineers.
Sept., 1931	Engineering headquarters opened at 500 Sansome Street, San Francisco.
Oct., 1931	Contract No. 1 awarded; covers moving of cables and borings at pier sites.
Jan., 1932	Act of Congress passed February 20, 1931, to permit construction of bridge via Yerba Buena Island extended and permits from War Department issued.
April, 1932	Financial Advisory Committee of prominent financial and business men appointed by Governor Rolph (Met and organized May 13th).
May, 1932	War Department approval of location and plans received.
Aug., 1932	Report of Department of Public Works forwarded to the Toll Bridge Authority; covers project history, laws, and its immediate and future effect on general economic welfare.
April, 1933	Approval of financing by the Reconstruction Finance Corporation received and contracts for main portion of bridge awarded.

The bridge was opened to highway traffic November 12, 1936, and to railroad traffic January 15, 1939. The time and cost of construction was less than anticipated. After ten years of service and with the basic toll gradually reduced from 60 to 25 cents, the authority foresees that all bonds will be retired and money borrowed from the State Highway Fund repaid in 1953.

It was estimated that revenues could liquidate the investment in twenty years. This was based on the prediction that traffic would reach 10,000,000 vehicles per annum in 1940 and increase thereafter at the rate of 3 percent per annum. For 1946, this premise is equivalent to 12,000,000 vehicles per annum or an average of 33,000 vehicles per day. Actual traffic is twice the predicted amount—in fact, now equals a volume which was not predicted until 1970.

This overrun of traffic has been recorded steadily from the day the bridge was opened—20 percent in 1937, 48 percent in 1939, 85 percent in 1941, 75 percent in 1943, 91 percent in 1945. It was gratifying to find that the conservatism and soundness of the self-liquidating financial plan was confirmed and that tolls could be reduced, but the continued growth of traffic developed undesirable congestion by 1941.

The need for an additional crossing was advocated at that time. Congress authorized study by a Joint Army-Navy Board of a proposal for a bridge from Hunter Point to Bay Farm Island. The board found that there was no immediate need from the standpoint of national defense and that construction then would divert materials required for urgent defense construction. An abstract of the findings is attached in Appendix A.

During the war, traffic increased materially although rationing of gasoline afforded some relief. But when rationing ended on August 15, 1945, the problem became acute. The authority directed this investigation on October 30, 1945, and Congress followed in March, 1946. with an authorization for another Joint Army-Navy Board to study the problem from the standpoints of national defense and peacetime economy.

Transbay Traffic

AY BRIDGE TRAFFIC

In 1946, bridge traffic averaged 69,000 vehicles per ay, of which 63,000 used the upper deck and 6,000 the wer deck. The peak day was April 21, 1946 (Easter), hen 79,016 vehicles were counted, 76,609 of them on e upper deck. There was serious congestion on this ay because of two multiple-car wrecks, but almost as reat a volume of traffic occurred on July 3 and Novemer 29, 1946, without special incident.

The traffic pattern has undergone a considerable hange. In 1940 the greatest traffic always occurred on veek-ends. At present, while week-end traffic has ncreased, the traffic during the five working days of he week is now the greater. This change indicates the rowing use of the bridge as an intercity business rtery. The year-day load factor (ratio of average daily oad to maximum daily load in a year) has increased rom 0.76 to 0.83.

The peak loads occur on week days on the westound lanes in the morning and a more concentrated raffic on the eastbound lanes between 4.45 and 5.45 .m., with concurrent westbound traffic three-quarters s great. A maximum hourly peak has been estimated t 7,300 on October 8, 1946, when 3,982 vehicles were ounted on the eastbound lanes of the upper deck. Thus the day-hour load factor is about 0.38 for the whole bridge and 0.32 for the eastbound lanes.

Congestion on the upper deck results from wrecked or stalled cars and from entering streams of side traffic. During peak hours the stopping of one lane and the swerving of cars into the adjacent lane reduces the effectiveness of the remaining two by more than half.

The number of vehicles using the lower deck averaged 9 percent of the total vehicular traffic. A maximum daily traffic of 9,151 vehicles was counted on October 28, 1946; of these, 73 percent were trucks and 27 percent were busses. Peak rate was 900 vehicles per hour.

Congestion on the lower deck has been caused by slow progress of heavy trucks on the grade at the San Francisco end and west of Yerba Buena Island as well as by turbulence at the island turnouts. Heavy truck accidents cause serious delay because of the narrower roadway and the use of heavy equipment. While it can not be said that with the present traffic pattern the economic capacity of the lower deck has been reached, it is close to the desirable limit.

Load factors increase as use of facilities approaches capacity. The daily load factor will increase by adjustment of business hours and shopping habits; the limit for reasonable safety and tolerable delay has been estimated at 85,000 vehicles per day. (Toll collection and approach facilities at the present time are not sufficient for this amount of traffic, but the facilities are now being improved.) The annual load factor may increase to 0.90, from which the annual capacity is estimated at 28,000,000 vehicles.

PRESENT TRANSBAY PASSENGER TRAFFIC AND REVENUE

All kinds of traffic which cross the Bay have been considered in the study. The following percentages, based on passengers using each form of transport during the year 1945, are of interest in considering the location and design of a second bridge:

Passengers carried by	*Percent*
Privately owned vehicles	45
Busses and interurban trains	53
Steam trains (crossing by ferry and bus, exclusive of military)	2

It is evident from these figures that provision for mass transportation on the present bridge was absolutely necessary to handle transbay interurban traffic.

Revenues collected on the San Francisco-Oakland Bay Bridge during 1945, segregated by mode of travel, were:

		Percent
Light passenger vehicles	$4,357,000	63
Trucks	1,377,000	20
Total, privately-owned vehicles	$5,734,000	83
Busses, Key System, Greyhound, Santa Fe, etc.	$536,000	8
Key trains	631,000	9
Total, mass transportation*	$1,167,000	17
Grand Total	$6,901,000	100

*Southern Pacific and Western Pacific mainline train passengers are transported across the Bay on Southern Pacific Company ferries.

The relative importance of the revenues collected from privately-owned vehicles should be noted.

SUITABLE BRIDGEHEADS

Before taking up the economy and feasibility of different forms of transport, the limiting conditions that governed the choice of particular crossing locations for study will be given.

This study confirms the fact that the present Bay Bridge location between Rincon Hill and the Key Route Mole via Yerba Buena Island is the most favorable one; this refers to economy of construction and convenience for both San Francisco and East Bay traffic.

The physiography of the San Francisco peninsula provides favorable conditions for a second bridge terminus in four general areas: (1) Telegraph Hill, (2) Rincon Hill, (3) Potrero Point, and (4) Hunter Point.

The East Bay shore is flat and locations for bridge termini are limited by the geography of the area, its harbor, and airfield developments. (Important developments are Oakland's Outer and Inner [Estuary] Harbors and the Naval Air Station in Alameda.) These conditions and the location of the termini on the San Francisco side limit the choice of terminal areas on the East Bay side to four general areas: (1) Key Route

Mole, (2) Oakland Mole, (3) Southerly line of Alameda, and (4) Bay Farm Island.

Because of more favorable foundation conditions, bridges which cross on or to the north of the line, Rincon Hill-Oakland Mole, should be located via Yerba Buena Island.

If the San Francisco terminus of a crossing is in the Potrero Point area, the crossing must be located south of the Naval Air Station to avoid interference with its entrances and the Oakland Harbor channels. This requires the East Bay terminus to be south of Alameda with a freeway crossing the Oakland Estuary in order to reach the East Bayshore Highway and the principal center of traffic in downtown Oakland.

The natural East Bay terminus for a Hunter Point Bridge is on Bay Farm Island because of the general geography of the region.

VEHICULAR TRAFFIC

Origin-destination counts of San Francisco-Oakland Bay Bridge traffic, supplemented by various other traffic data, are available to show the distribution of transbay vehicular traffic. The following pertinent conclusions come from a study of the data. (See Plate II-1 showing the traffic distribution referred to).

Of all the present bridge traffic, 55 percent stops or starts in the principal downtown area of San Francisco, both north and south of Market Street. Of all traffic, 79 percent stops or starts in this downtown area and the part of the city directly west and north of it, including Treasure Island.

Of all present bridge traffic, 65 percent stops or starts north and west of a line following 14th Street, Lake Merritt, MacArthur Blvd. and High Street in Oakland.

The center of gravity of transbay traffic on the San Francisco and that portion of the East Bay cities south and east of the above described line amounts to only 8 percent of the bridge traffic. Direct traffic between the northerly areas on each side amounts to 50 percent, or six times as much.

The center of gravity of transbay traffic on the San Francisco peninsula has moved south and west a small amount since 1932. The movement in the East Bay Area has been north and west. No future movement of sufficient magnitude to affect the choice of location for a second bridge is indicated.

No location other than one in close proximity to the existing bridge is likely to divert anything like half the traffic now using the San Francisco-Oakland Bay Bridge. It is estimated that a crossing on the location Potrero Point-Alameda will not divert more than 20 percent of its present traffic and one on the Hunter Point-Bay Farm Island location not more than 5 percent.

New developments in the areas directly tributary to these locations can, in time, produce a considerable volume of additional traffic but it is doubtful if ters of gravity of the main traffic generating ar be materially changed within the toll collecting Therefore, *congestion on the present bridge ca relieved for very long, or to any great degree, construction of a second bridge south of the vicinity of the Yerba Buena Island locations.*

It is estimated that the bridge would agai the limit for reasonable safety and tolerable r 85,000 vehicles per day at the dates indicated for various crossing proposals:

Location of second crossing	*Date when SF-OBB wo again be congested*
Hunter Point-Bay Farm Island	Between 1954 and 1
Potrero Point-Alameda	Between 1961 and 1
Rincon Hill-Key Mole	Beyond time limit o reasonable predic

TERMINI FOR YERBA BUENA ISLAND LOCATION

East Bay Termini. Comparing termini o Mole and on Oakland Mole the latter has the foll disadvantages: (1) A long span (on the order of feet) is required to provide clearance over the Oa Harbor Channel just to the west of the Mole, (2) dation conditions for the piers of such a long spa poor, (3) the elevation of the bridge for clearanc interfere with the flight of planes from the Nava Station, (4) also because of this elevation, the b deck can not reach ground elevation until near P Street in Oakland. The studies show that a ter on Key Mole of a bridge parallel to the north o present one having suitable connections is the practical one.

San Francisco Termini. The choice betw Telegraph Hill and Rincon Hill terminus is larg matter of the relative cost and feasibility of provi proper facilities for traffic distribution in the d town area, both north and south of Market Street.

A terminus on Telegraph Hill is not as suitab one in the Rincon Hill area, which has the follo advantages: (1) The greater proportion of vehic traffic is generated in the downtown area south of ket Street, (2) the topography, property developm and street plan is relatively favorable, (3) it prov a direct connection with the proposed Bayshore F way and its connections, (4) other freeway con tions reaching the Potrero District and beyond ca constructed as needed, and, (5) it permits more f ble provisions for handling traffic in connection the existing bridge.

TERMINI SOUTH OF YERBA BUENA ISLAN

A terminus in the Potrero District of San Fr cisco has certain features to recommend it: (1) terminal area is less congested than in the vicinity the present bridge and the immediate approach fa

ties will be less costly, (2) connection with the proposed West Bay Shore Freeway is feasible, (3) large business and industrial development is possible in the area directly tributary to the bridge end. Against these features may be set the following: (1) It can only serve for a crossing terminating in, or near to, the south of Alameda, which will require expensive construction through Alameda and across the Estuary to reach the main center of traffic in Oakland, (2) it requires the immediate construction of a long freeway connection along the waterfront area to tap the main downtown section, and, (3) as a result it will divert a relatively small part of the traffic and in consequence will not relieve the congestion on the present bridge. Comparative distances via Rincon Hill-Key Mole and via the Alameda terminus, when the desirable freeway connections linking the termini are constructed, are as follows:

From San Francisco	*To East Bay*	*Via Rincon Hill*	*Via Potrero Point*
Potrero District	Center of all traffic	11 mi.	12¼ mi.
Potrero District	14th and Broadway	11½ mi.	9¼ mi.
Center of all traffic	Center of all traffic	10¼ mi.	14½ mi.

From this tabulation it will be seen that a Rincon Hill-Key Mole location serves existing traffic between Potrero Point and the East Bay area as a whole as well or better than a Potrero Point-Alameda location. The latter has the advantage in distance for traffic going to the center of the downtown business district of Oakland but it will be noted that two-thirds of the East Bay traffic comes from the north of this point. The Rincon Hill location provides the shortest route between the centers of gravity of all traffic on each side of the Bay.

INTERURBAN RAIL AND BUS TRAFFIC

Under the present conditions the interurban railway on the San Francisco-Oakland Bay Bridge is an essential form of transportation for handling peak-hour traffic. The capacity of the bridge roadway and terminal facilities would not permit the handling of present train passengers by buses and private vehicles.

The number of passengers carried by the Bridge Railway, including government employees going to and from Treasure Island, rose to 37 million for the year 1945, 11 million of which were government toll-free passengers. Because of the large decrease in war activities, indications are that train passengers will not exceed 22 million during 1947.

Bus passengers have shown a steady increase since 1943, the increase for 1946 over 1945 traffic amounting to 3 percent. Added convenience in the use of automobiles and busses which should result from the building of a second crossing is likely to cause a further decrease in interurban train traffic.

Since the Bridge Railway during wartime was capable of handling nearly twice as many passengers as now use it, and could be made to handle more if necessary, no provision for additional rail facilities seems justified.

Navigation

The navigation clearances required for the San Francisco-Oakland Bay Bridge and official statements in the records of the two Joint Army-Navy Board investigations (Appendices A and B) establish the following minimum requirements for a new crossing.

(1) A low-level bridge south of Hunter Point must clear a channel 450 feet wide to a height of 140 feet above MHHW.

(2) A high-level bridge in the vicinity of the existing bridge or north of it should match its clearance in the West Bay crossing and in the main span of the East Bay crossing.

(3) A high-level bridge near the Potrero-Alameda line will have one span clearing a channel 1,000 feet wide to a height of 214 feet. It should be anticipated that two such spans may be required, or that a single 1,700-foot channel will be specified with vertical clearance of 214 feet at center and 180 feet at piers.

Steam Railroads

Three interstate rail systems terminate rails in Oakland and transfer passengers to San Francisco. The Southern Pacific Company and Western Pacific Railroad transfer by ferry and the Atchison, Topeka and Santa Fe Railway operates busses over the bridge. These transfers amounted to 4 percent of the transbay passenger volume in 1945, but a large portion was military traffic. In 1940 the proportion was only 2 percent and will probably retreat to this ratio.

For freight, the Western Pacific and Santa Fe operate car ferries and the Southern Pacific uses its Dumbarton Cut-off to its San Francisco yards.

The railroads have expressed no dissatisfaction with these arrangements. However, there has been public demand for extension of the rail systems to provide rail termini in San Francisco, and the possibility of providing such facilities as part of a new crossing was thoroughly investigated.

RAILROADS NORTH OF HUNTER POINT

So far only a high-level bridge, or a tube, is permissible north of Hunter Point, because of the limitations imposed by airfields, navigation, and the naval anchorage. Provision for main line railroad trains on a long-span structure not only requires additional roadway space but adds greatly to the cost of the main bridge members. On such a structure the rail elevation will be 200 feet above the elevation of the terminals, and approach grades of 1 percent are the maximum that can be effectively operated over by passenger trains or short freight trains and then only at slow speed. This would require over four miles of approach between the bridge end and the rail terminals.

The cost of providing railroad tracks through a tube may be practically divorced from that of providing for vehicular traffic, since separate tubes and terminal facilities are required. Grades at least half as long as those required for the high-level bridge are necessary to get from ground level to the grade of the tubes under the ship channel. Ventilation difficulties will make it advisable to prohibit the use of steam power through the tube which will result in increased capital and operating costs due to the conversion to electric or diesel motive power. Therefore, neither a tube nor high-level bridge is feasible for main line railroads crossing north of Hunter Point.

HUNTER POINT RAIL-VEHICULAR BRIDGE

Since a Hunter Point-Bay Farm Island location will divert but 5 percent of the San Francisco-Oakland Bay Bridge vehicular traffic, it offers no solution for the existing congestion on that structure. Its feasibility depends on whether it can be justified by the diversion of present and generation of new traffic, the economies provided by rail transportation, or by contributions from other sources.

It is certain that the financing of the railroad sh of the initial capital investment by tolls collected f vehicles on both bridges would be resisted by moto using them. The railroad share of the cost of the Hu Point-Bay Farm Island structure alone is estimate be $65,000,000, and the cost for moving and expand yards, shops, and other terminal facilities would of like magnitude.

Very little Southern Pacific Company freight w be diverted from the Dumbarton Cut-off to a Hu Point crossing. The car ferries used to handle West Pacific and Santa Fe freight cars had sufficient capa to handle the abnormal volume of war traffic, so there is little need for either of these roads to acq additional freight facilities. Some saving in opera costs seems possible by the use of transbay rails, they are not nearly sufficient to justify the large a tional investment.

No saving in time of most of the passengers cr ing the Bay to San Francisco would result from building of the Hunter Point bridge. It is estima that there will be a loss of 10 or 15 minutes for Sou ern Pacific and Santa Fe passengers and a poss but very slight saving in time for Western Pac passengers, but the latter constitute but a small p portion of the total train passengers. Delays due raising the lift span result in more or less frequ unscheduled delay.

Areas in San Francisco close enough to the cen of the city to provide for the large additions to ya and terminal facilities, together with necessary str separations and parking spaces, will be extremely cos and disrupt many existing business locations a services thereto.

The total number of train passengers carried by three railroads across the Bay during the year 19 included military traffic, which cannot be segrega from civilian traffic. It is expected that the postw volume of train passengers will fall close to the 19 count, which was:

	Passengers	*Perce*
Southern Pacific, via S. P. Co. ferries	767,040	78.2
Western Pacific, via S. P. Co. ferries	21,410	2.2
Santa Fe, via busses	192,628	19.6
Total	981,078	100.0

The charge for transporting passengers across Bay in Key System busses or trains is 25 cents. Assu ing this to be the cost of transporting main line p sengers, the total annual cost of transporting 1,000,0 passengers would be $250,000. Even if this total c could be saved by the railroads it would finance more than $8,000,000 of improvement work. It is e dent, therefore, that even the most optimistic estim of savings in operating costs would not justify investment by the railroads in a passenger termi alone.

Foundations

San Francisco Bay is a submerged valley in which the bed shales and sandstones lie at widely differing elevations. Outcrops appear as islands, rock points, and reefs, such as Yerba Buena Island, Mission Rock, and Rincon Reef. The deep of the valley is probably east of the axis of the Bay because alluvial cones have filled more of the eastern part. Evidently, also, this deep extends toward the existing valleys, such as Mission and Islais Creeks, which are vestiges of the branches of the ancient valley.

Overlying the bedrock are irregular alluvial deposits, the lowest being lenticular masses of clays, sands, and gravels generally suitable for pile foundations. Except where strong tidal currents have prevented such deposits, the uppermost are soft clays and fine muds of little supporting value. There are some soft materials encased by the stiff alluvium, and there is evidence that marsh peat underlies some East Bay deposits.

The great irregularity of foundation materials requires careful exploration to control design and considerable preliminary exploration for tentative design and reliable estimate of construction cost.

It was arranged to extend the results of previous foundation exploration along the locations selected for study. These lines were generally:

(1) Telegraph Hill to Key Mole, via Yerba Buena Island (Locations Nos. 2, 3, 4, 6, and 7);

(2) Near and parallel to the existing bridge (Locations Nos. 5, 8, and 9);

(3) Potrero Point to Alameda (Locations Nos. 10, 10A, and 12);

(4) Candlestick Point to Bay Farm Island (Location No. 11).

PREVIOUS EXPLORATIONS

In 1930, as a part of its study for the Hoover-Young San Francisco Bay Bridge Commission, the department put down 41 jet borings aggregating 7,897 feet and four diamond-drill borings aggregating 837 feet at a contract cost of $32,147. Most of this exploration was pertinent to the new study.

The construction record for the San Francisco-Oakland Bay Bridge added positive information along one line, giving some idea of irregularity of bedrock, reliability of borings, and proper factors of interpretation.

In 1932 after the general location of the bridge had been determined, intensive explorations were made in the vicinity of pier sites to adjust the line and design the sub-structure. Borings made at this time were used to establish minimum and probable elevations of the cutting edge of each caisson. They have not been published, but were available and used in the analysis.

During the war, the U. S. Navy explored the area around Hunter Point intensively for control of dry dock and breakwater construction. Logs of these borings were made available to the department, but none located bedrock.

NEW BORINGS

New borings for the present study were secured by contract at a cost of $22,841.90. All borings were made with a high-pressure jet, the forty holes aggregating 11,000 feet below MLLW.

A location in the vicinity of the existing bridge is most favorable for any high-level, long-span structure because of the submerged rock saddle between Rincon Hill and Yerba Buena Island. The general rock levels had been fixed by previous borings and construction experience, but additional data was desired for comparison of new locations each side of the existing bridge. Logs of all new borings are compiled in this Appendix F.

FOUNDATION ANALYSIS

Study of all old and new explorations confirmed or established with reasonable assurance the depth and nature of foundation materials available along each location, as follows:

(1) The West Bay crossing of the existing San Francisco-Oakland Bay Bridge is situated on the ridge of the saddle between Rincon Hill and Yerba Buena Island, so the piers for a parallel bridge would be founded deeper. The extra depth is not great for the deeper piers.

(2) West Bay piers on a line 350 feet north of the existing bridge (Locations 8 or 9) would be founded slightly deeper than if on a line the same distance south of the existing bridge.

(3) For West Bay crossings between Telegraph Hill and Yerba Buena Island (Locations 2, 3, 4, 6, or 7) the depths to rock are similar along the several lines and materially greater than along the existing bridge.

(4) For East Bay crossings from Yerba Buena Island to Emeryville or Oakland (Locations 2, 3, 4, 6, 7, 8, and 9) rock foundation is available only in the vicinity of the Island. Foundation materials for the rest of the crossing do not differ much between the several locations.

(5) For Locations 10 and 12 between Potrero Point (or Army Street) and Alameda, seven borings to depths of 295 to 327 feet failed to reach bedrock.

(6) For Location 11 between Candlestick Point and Bay Farm Island, materials are satisfactory only for relatively short spans on pile foundations. At three miles from Candlestick Point, hard or soft shale was found at a depth of 182 feet, wh may be usable for support of channel piers.

Estimated Costs

In estimating the cost of constructing each of several crossings that are being studied the pres

GENERAL DESCRIPTION AND COST OF LOCATIONS STUDIED

Location number	San Francisco terminal area and connections	Notes	East Bay terminal area and connections
		Telegraph Hill Bridges	
2	Telegraph Hill (Lombard Street)	Via Yerba Buena Island	North of Key Mole (Stanford Avenue) Emeryville
4	Telegraph Hill (Lombard Street)	Traffic Interchange on Yerba Buena Island. New structure straddles present bridge	South of Key System Mole Oakland (22d Street)
7	Telegraph Hill (Broadway)	Via Yerba Buena Island	Key System Mole (North Side)
3	Telegraph Hill (Broadway)	Traffic Interchange on Yerba Buena Island. New structure straddles present bridge	Oakland Mole (East Bayshore Freeway)
6	Telegraph Hill (South Side)	Traffic Interchange on Yerba Buena Island. New structure straddles present bridge	Oakland Mole (East Bayshore Freeway)
		Rincon Hill Bridges	
8	Rincon Hill	Via Yerba Buena Island	Key System Mole (North Side)
9	Rincon Hill	Traffic Interchange on Yerba Buena Island. New structure straddles present birdge	Oakland Mole (East Bayshore Freeway)
		Transbay Tube	
5	Rincon Hill (South of Fourth Street)	Continuous curve of 32,800-ft. radius	Oakland Mole (Between 6th and 7th Sts.)
		Potrero Point-Alameda Crossings	
10	Potrero Point		South Side Alameda (Webster and Sixth Streets)
10A	Potrero Point		South Side Alameda (Webster and Sixth Streets)
12	Potrero Point (Army Street)		South Side Alameda (Webster and Sixth Streets)
		Hunter Point Bridge	
11	Hunter Point (Candlestick Point)		Bay Farm Island, Alameda (East Bayshore Freeway)

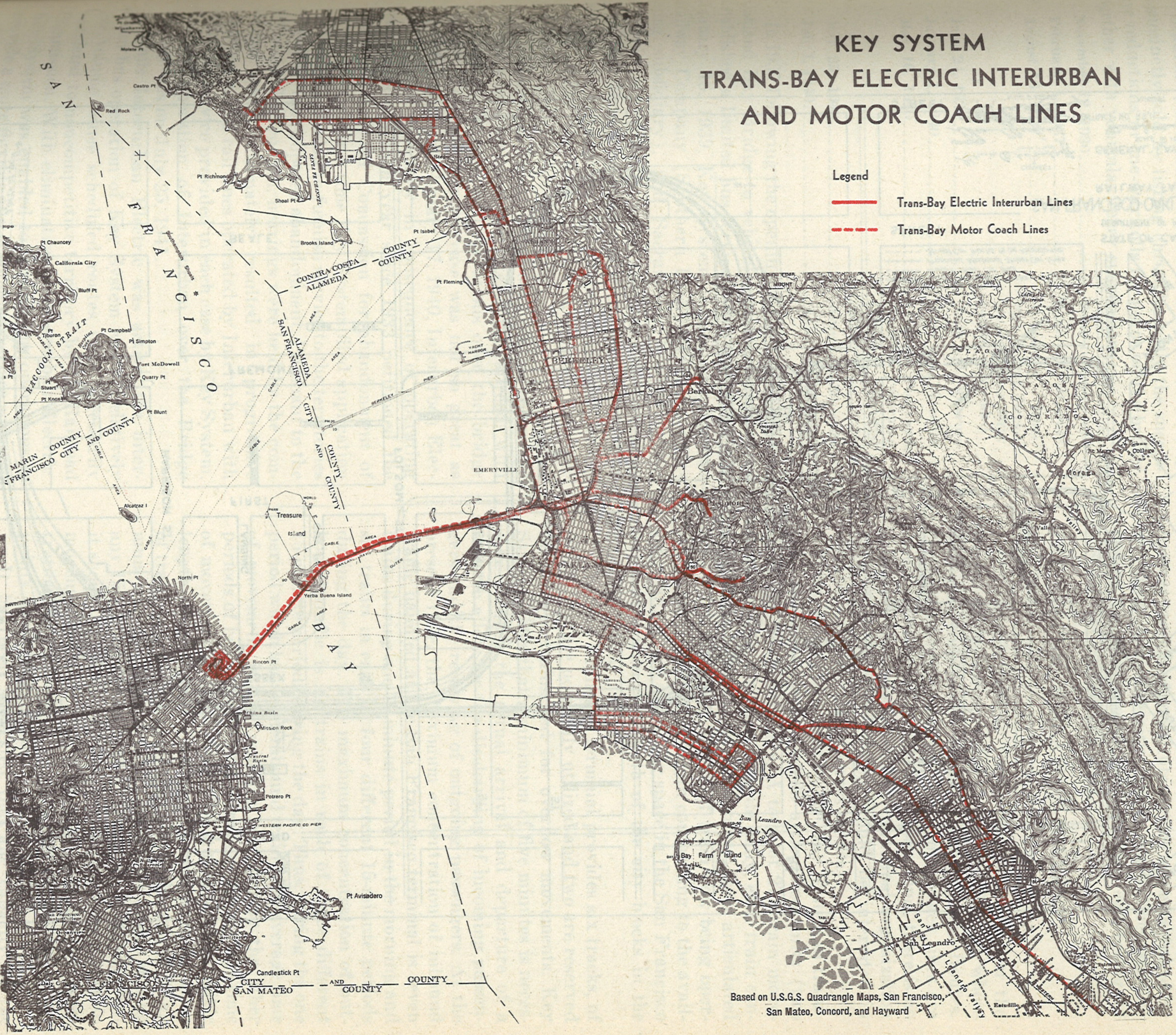
bridge furnishes a basis for quantities and unit costs. In order to bring these costs in line with present, or expected price levels recourse is had to cost indexes prepared by various organizations and chiefly to the Building Cost Index prepared by *Engineering News Record*, which is the most applicable to bridge construction.

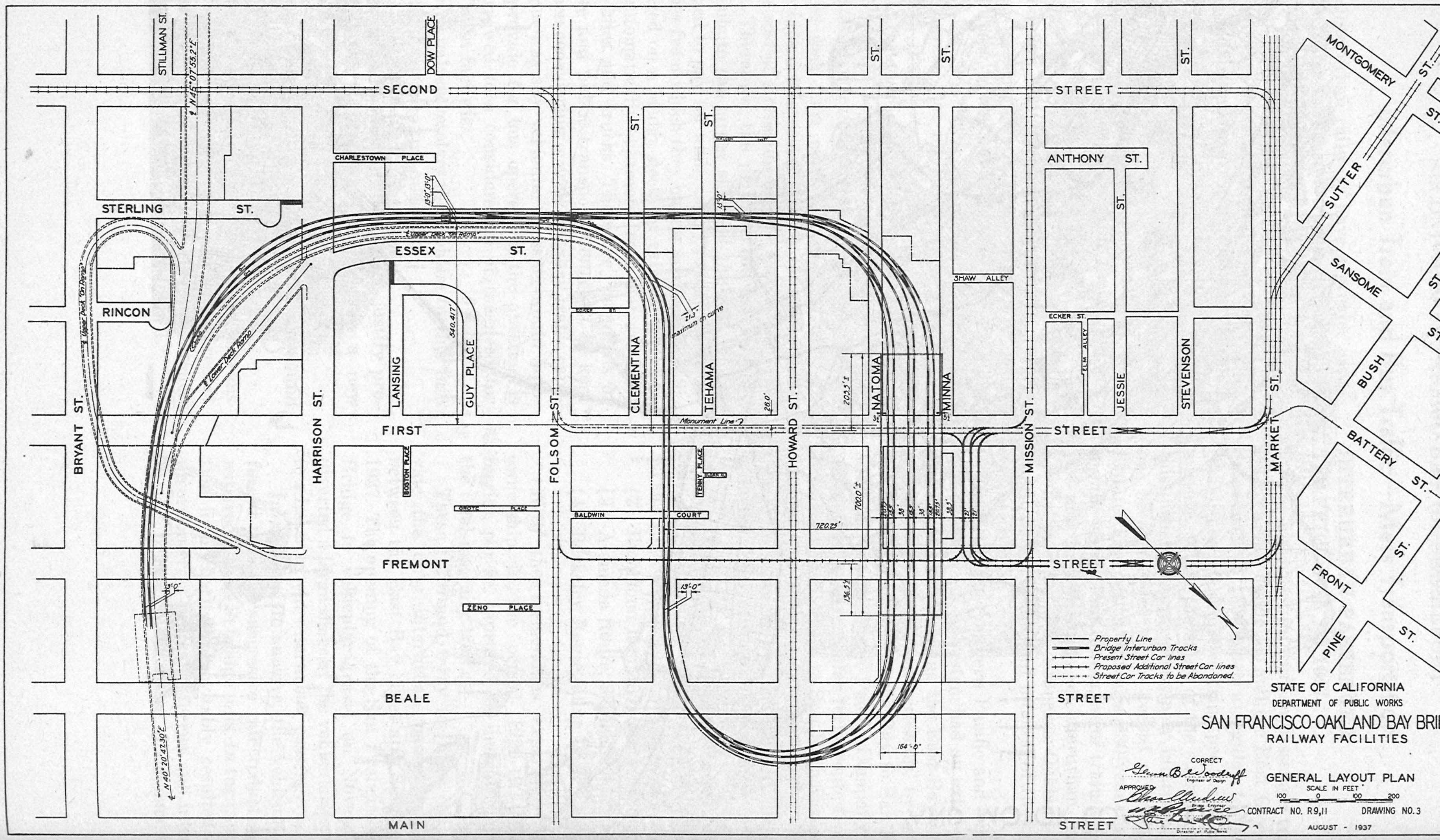
In presenting estimates of the different locations it must be kept in mind that they do not provide equivalent traffic facilities or capacities. Neither is the degree of interference with navigation, harbor facilities, or industry in the terminal areas comparable. The cost, therefore, is but one factor in a comparison of the relative merits of the locations.

The following tabulation summarizes the physical features and costs of these locations:

GENERAL DESCRIPTION AND COST OF LOCATIONS STUDIED—Continued

East Bay terminal area and connections	Location number	Type of structure	Type of traffic	Arrangement of lanes	Estimated costs
		Telegraph Hill Bridges—Continued			
f Key Mole ford Avenue) yville	2	Four-span suspension bridge, West Bay; steel truss and cantilever spans East Bay	Vehicular only	Five or six each deck	$103,000,000
f Key System Mole nd (22d Street)	4	Four-span suspension bridge West Bay; steel truss and cantilever spans East Bay	Vehicular only	Five or six each deck	$105,400,000
tem Mole n Side)	7	Three or four span suspension bridge West Bay; steel truss and cantilever spans East Bay	Vehicular only	Five or six upper deck. None, four or five lower deck	$134,000,000
Mole Bayshore Freeway)	3	Four-span suspension bridge West Bay; steel truss and cantilever spans East Bay	Vehicular only	Five or six each deck	$102,000,000
Mole Bayshore Freeway)	6	Four-span suspension bridge West Bay; steel truss and cantilever spans East Bay	Vehicular only	Five or six each deck	$101,000,000
		Rincon Hill Bridges—Continued			
em Mole Side)	8	Entire bridge twin of present—300 ft. or more north	Vehicular only	Five or six upper deck; two or three lower deck	$84,000,000
Mole Bayshore Freeway)	9	Bridge West Bay Twin of present; steel truss and cantilever spans East Bay	Vehicular only	Five or six upper deck; two to five lower deck	$103,000,000
		Transbay Tube—Continued			
Mole en 6th and 7th Sts.)	5	Two or more tubes	Vehicular only or combination rail-vehicular	Two 12-ft. lanes each tube, total four to eight lanes. Possible two rail tracks, one tube but no plans or estimates made	$167,000,000
		Potrero Point-Alameda Crossings—Continued			
e Alameda er and Sixth Streets	10	Steel truss spans with cantilever structure across channel	Vehicular and steam railroad	Four upper deck. Two lanes and two railroad tracks lower deck	$108,000,000
e Alameda er and Sixth Streets	10A	Steel truss spans with cantilever structure across channel	Vehicular only	Four upper deck; two or four lower deck	$83,000,000
e Alameda er and Sixth Streets	12	Mole, viaduct, and tube combination	Vehicular only or combination vehicular and steam railroad	Two lanes each tube. Total six or eight lanes. Possible two railroad tracks one tube, but no plans or estimates made	$137,000,000
		Hunter Point Bridge—Continued			
Island, Alameda ayshore Freeway)	11	Steel spans with lift span across channel	Vehicular and steam railroad	Four upper deck; four railroad tracks or two lanes, and two railroad tracks lower deck	$130,000,000


KEY SYSTEM
TRANS-BAY ELECTRIC INTERURBAN
AND MOTOR COACH LINES
Legend
Trans-Bay Electric Interurban Lines
Trans-Bay Motor Coach Lines
SAN FRANCISCO
BAY
CONTRA COSTA COUNTY
ALAMEDA COUNTY
SAN FRANCISCO CITY AND COUNTY
MARIN COUNTY
SAN MATEO COUNTY
RACCOON STRAIT
Red Rock
Pt Richmond
Brooks Island
Pt Isabel
Pt Fleming
BERKELEY
EMERYVILLE
Treasure Island
Yerba Buena Island
Alcatraz I
Pt Blunt
Rincon Pt
Potrero Pt
Pt Avisadero
Candlestick Pt
Bay Farm Island
San Leandro
Based on U.S.G.S. Quadrangle Maps, San Francisco, San Mateo, Concord, and Hayward


SECOND STREET
FIRST STREET
FREMONT STREET
BEALE STREET
MAIN STREET
BRYANT ST.
HARRISON ST.
FOLSOM ST.
HOWARD ST.
MISSION ST.
MARKET ST.
STERLING ST.
ESSEX ST.
RINCON
STILLMAN ST.
DOW PLACE
CHARLESTOWN PLACE
LANSING
GUY PLACE
BOSTON PLACE
GROTE PLACE
ZENO PLACE
CLEMENTINA ST.
TEHAMA ST.
TENNY PLACE
BALDWIN COURT
NATOMA ST.
MINNA ST.
SHAW ALLEY
ANTHONY ST.
ECKER ST.
ELM ALLEY
JESSIE ST.
STEVENSON ST.
MONTGOMERY ST.
SUTTER ST.
SANSOME ST.
BUSH ST.
BATTERY ST.
FRONT ST.
PINE ST.
maximum on curve
Monument Line
Property Line
Bridge Interurban Tracks
Present Street Car lines
Proposed Additional Street Car lines
Street Car Tracks to be Abandoned.
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE
RAILWAY FACILITIES
CORRECT
Engineer of Design
APPROVED
Bridge Engineer
Director of Public Works
GENERAL LAYOUT PLAN
SCALE IN FEET
100 0 100 200
CONTRACT NO. R9,11
DRAWING NO. 3
AUGUST - 1937

Terminal Areas Studied

has been stated that because of the physical con- and immediate traffic requirements of the Bay the San Francisco end of the bridge should not of Hunter Point. As described previously in report, foundation conditions, topography, traffic and property developments indicate the more termini on the San Francisco side to be in general vicinity of (1) Telegraph Hill, (2) Rincon (3) Potrero Point, and (4) Hunter Point. On the side of the Bay the termini are limited by geog- location and course of ship channels, and by and harbor developments to (1) the general of the easterly end of the present bridge, (2) Oakland Mole, (3) the westerly part of Alameda, (4) Bay Farm Island.

TYPES OF CROSSINGS. Various types of bridges, high and low level, with and without provision steam railroad trains, have been considered. A four- tube the full width of the Bay has been considered amplifies the data on a tunnel line contained in report of the Hoover-Young Commission. A study combination tube, fill, and viaduct extending from Street in San Francisco to Alameda has been This crossing serves the same area as a high-level location terminating in the vicinity of 20th where favorable topographic conditions are to found.

TELEGRAPH HILL. Five of the locations chosen for terminate in the Telegraph Hill area—two (2, 4) the line of Lombard Street, one (6) in the vicinity Washington Square, and two (3, 7) on the line of Broadway. The choice between these termini depends primarily on the relative practicality of building suit- connections to the business districts. The terrain off abruptly to the south from Telegraph Hill and a considerable length of approach structure would be necessary to develop the proper grade.

EAST BAY TERMINALS. Locations 2 and 4 terminate in the vicinity of the present bridge in Oakland and permit a study of variations from the present bridge line, since they lead directly to Stanford Street and 22d Street respectively. Location No. 7 is parallel to the easterly end of the present bridge, and Locations 3, 6, and 9 terminate on the Southern Pacific (i.e. Oakland) Mole. These terminal locations permit studies of practicable layouts crossing Yerba Buena Island.

RINCON HILL. Three locations terminate on the Rincon Hill Area. Locations 8 and 9 are for a bridge parallel to the existing bridge and some 325 feet to the north of it. The East Bay termini of these locations are parallel to the existing bridge and on the Oakland Mole respectively. These layouts likewise permit a study of practicable Yerba Buena Island crossings and connections. Location No. 5 is a tube line in the vicinity of Rincon Hill and its study amplifies that of a tunnel line considered in the report to the Hoover-Young Commission.

POTRERO POINT. Two locations terminate in the area around Potrero Point. Location No. 10 is a high level structure terminating on the line of 20th Street in San Francisco and in the East Bay at the foot of Webster Street in Alameda. Location No. 12 is a combination tube and causeway terminating on the line of Army Street in San Francisco and at Webster and Sixth Streets in Alameda. This San Francisco terminus for a tube crossing can be compared with the high level bridge located in the vicinity of 20th Street, where favorable topographic conditions are to be found.

General Design Requirements

To decide on the practicability of different struc- designs and to make reasonable cost estimates, it necessary to adopt uniform design standards to be in making the comparisons. Important factors in design include navigation clearances, roadway capacity, and loadings. For preliminary studies the standards used in designing the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge serve as a satisfactory precedent.

NAVIGATION AND AVIATION REQUIREMENTS

CLEARANCES

VERTICAL CLEARANCE. The vertical clearance fixed the War Department for the Golden Gate Bridge was 220 feet at mid-span and 210 feet at the towers. In the case of the San Francisco-Oakland Bay Bridge the required clearance was 180 feet at the San Francisco Pierhead Line and 214 feet above mean higher high water near the center of the West Bay Crossing. The main channel clearance on the East Bay crossing is 185 feet. The Army and Navy Board Report of 1941 for a bridge from a point just north of Hunter Point to Bay Farm Island used a vertical clearance of 214 feet above high water.

These vertical clearances make it advantageous to locate the San Francisco bridgehead in one of the elevated areas which have been mentioned, otherwise the approach section will be long. In the case of all but one terminal location on the East Bay side, the clearances required over the ship channels are lower and the water crossings are longer, so it is not so necessary that the bridgehead be located in an elevated area.

Horizontal Clearances. The horizontal clearance for the main span of the Golden Gate Bridge was covered by a permit issued by the War Department August 11, 1930, which required a minimum span length of 4,200 feet. The clear distance between the fenders of the main piers is slightly less than 4,100 feet. The horizontal clearance for the West Bay spans of the San Francisco-Oakland Bay Bridge was fixed at 1,000 feet by the War Department.

Yerba Buena Islands Clearances. Several of the proposals involve viaducts in crossing Yerba Buena Island, on which the Navy Department maintains buildings and other facilities. Some cut-and-fill construction will be required and the viaducts will have to pass over certain government buildings. However, it appears feasible to locate trestle bents and limit the fills so that only minor rearrangement or reconstruction of buildings will be necessitated. Permission must, of course, be secured and arrangements made with the military authorities for island right-of-way, but all the preliminary layouts for a crossing of the island are designed to cause a minimum of interference with military establishments.

Clearance for Aircraft. The effort has been made to locate the towers of the bridges sufficiently distant from airfields to provide a minimum of interference with land-based aircraft. The same applies to flying boats or amphibious planes for the locations north of the present bridge, since the towers or trusses will not encroach on the glide angle of any present landing location. However, a bridge or causeway between Alameda and Potrero Point will offer serious interference with flying boats operating from the Alameda Air Base as will a long span structure crossing the Oakland Outer Harbor Channel on a location terminating on the Oakland Mole.

SPAN LENGTHS

Various span lengths for that portion of a bridge which crosses the Bay to the west of Yerba Buena Island have been studied and compared. The economic span lengths must fit navigation requirements as well as meet topographic and sub-surface conditions. Plate V-1 shows three different combinations of suspension spans crossing the West Bay between San Francisco and Yerba Buena Island.

For a parallel structure the pier locations and span lengths must conform to the existing Bay Bridge. Bridges to the north of the present bridge will require longer main spans because of anchorage conditions, location of the pierhead line, and other restrictions imposed by navigation. To minimize the obstruction to the docking of ships, bridge piers in this area have been located so that each of those along the pierhead line will be at the end of a harbor wharf. The other main piers for the West Bay structures are located to provide clear channels for water-borne traffic through both the present and the new bridges. It is believed that all piers are so located as to cause little if any hazard or interference with the movement of ships, whether docking, shifting to new locations, or moving from the Golden Gate to the upper regions of the Bay.

TYPES OF SPANS

For the length of spans required for a West Bay structure north of the existing bridge, the suspension type was found to be most economical, and the following three arrangements were considered:

(1) Five-spans, with an achorage in the middle of the center span, which causes the structure to function as a pair of three-span bridges. This is the arrangement that is used for the present bridge.

(2) Four-spans—2,900-foot main spans and two side spans, or 3,100-foot main spans and two side spans.

(3) Three-spans—a 4,800-foot main span and 2,[illegible]-foot side spans.

Preliminary layouts were made using all three types north of the present bridge. The layouts show that the piers for any arrangement of spans other than the four-span or three-span arrangement, (2) or (3) above, interferes with water-borne traffic in the main shipping channels, and that the five-span bridge is only satisfactory in the case of a parallel bridge.

The four-span bridge proved more economical to build than the three-span, 4,800-foot structure, and consequently was used for Locations 2, 3, 4, and [illegible]. Although this type of structure is not common and has been used in only a few instances, its past performances have been satisfactory. In fact, a bridge of the size and type contemplated has never been constructed and many engineers frown on four spans on account of the increased deflection from live loads over that found in the more orthodox three-span bridge. Dynamic wind force action would have to be considered and given serious study as well.

Prior to the selection of the type of structure adopted for the present West Bay portion of the San Francisco-Oakland Bay Bridge, one-hundred scale model tests were made at the University of California on two, three-span suspension bridges and on one four-span bridge. It was known at the time that electric interurban trains were to be carried on the bridge and that the maximum grade these trains could negotiate and maintain a reasonable schedule, was three percent. The four-span bridge was dropped from further con-

location as it was known to be too flexible to maintain a three percent grade.

The final report for the San Francisco-Oakland Bay Bridge had the following comments concerning these multiple-span bridges:

> Considerable study was given to a multiple-span design; studies being made with tie cables and also with a less flexible stiffening truss. For a bridge with vehicular loads only and assuming probable conditions of unbalanced loads, multiple-spans, either with or without a tie cable have great possibilities. With interurban loading it was difficult to secure the desired rigidity.

Further studies and analyses would have to be made before this type of bridge could be adopted for any of the above-mentioned locations, but taking into consideration the results of model tests and the fact that unbalanced live loads from electric cars will not be involved, it is believed that four-spans without intermediate anchorages could be used satisfactorily.

ROADWAY REQUIREMENTS

Plate V-2 shows the roadway cross-sections for the San Francisco-Oakland Bay Bridge and a section tentatively proposed for Locations 2, 3, 4, and 6. The upper deck of the present bridge has six 9.7-foot lanes with only a six-inch center dividing strip, and the lower deck, which is used by heavy vehicles only, has a 31-foot, three-lane roadway. This does not lend itself to safe operation even when the lanes are not operating to full capacity.

The following table lists the various roadway layouts used at the different sites. Alternative lane widths are listed to show the possibilities which might be used in any final design. Locations 2, 3, 4, and 6 were planned with a 60-foot width, which permits either six 10-foot or five 12-foot lanes.

ROADWAY ARRANGEMENTS AND LANE WIDTHS

Location number		West Bay		East Bay	
		Upper deck	Lower deck	Upper deck	Lower deck
1 (S.F.-O.B.B.)	Design	6 @ 9 2/3 ft.	3 @ 10 1/3 ft.	6 @ 9 2/3 ft.	3 @ 10 1/3 ft.
	*Alternate	5 @ 11 3/5 ft.	2 @ 15 1/2 ft.	5 @ 11 3/5 ft.	2 @ 15 1/2 ft.
2, 3, 4, 6 (4-Span Bridges)	Design	6 @ 10 ft.	6 @ 10 ft.	6 @ 10 ft.	6 @ 10 ft.
	Alternate	5 @ 12 ft.	5 @ 12 ft.	5 @ 12 ft.	5 @ 12 ft.
7 (3-Span Bridge)	Design	6 @ 13 1/3 ft.	None	5 @ 12 ft.	5 @ 12 ft.
	Alternate	6 @ 13 1/3 ft.	4 @ 14 ft.	5 @ 12 ft.	5 @ 12 ft.
8 (4-Span Bridge)	Design	6 @ 9 2/3 ft.	3 @ 10 1/3 ft.	6 @ 9 2/3 ft.	3 @ 10 1/3 ft.
	*Alternate	5 @ 11 3/5 ft.	2 @ 15 1/2 ft.	5 @ 11 3/5 ft.	2 @ 15 1/2 ft.
9 (4-Span Bridge)	Design	6 @ 9 2/3 ft.	3 @ 10 1/3 ft.	5 @ 12 ft.	5 @ 12 ft.
	*Alternate	5 @ 11 3/5 ft.	2 @ 15 1/2 ft.	5 @ 12 ft.	5 @ 12 ft.

Location No.		Upper deck	Lower deck	Remarks
10 (Potrero Point)	Design	4 @ 13 ft.	2 @ 14 ft. + 2 R.R. tracks	1–4 ft. dividing strip upper deck
	Alternate	4 @ 14 ft.	2 @ 14 ft. + 2 R.R. tracks	No dividing strip upper deck
10A	Design	4 @ 13 ft.	2 @ 14 ft.	1–4 ft. dividing strip upper deck
	Alternate	4 @ 14 ft.	4 @ 14 ft.	No plans or estimate made
11 (Hunter Point)	Design	4 @ 13 ft.	4 R.R. tracks	1–4 ft. dividing strip upper deck
	Alternate	4 @ 14 ft.	2 @ 14 ft. + 2 R.R. tracks	No plans or estimate made

Location number		Lanes in tubes	Remarks
5 (Tubes)	Design	4 @ 12 ft.	Total two tubes
12 (Mole-tube combination)	Design	8 @ 12 ft.	Total four tubes
	Alternate	6 @ 12 ft. + 2 R.R. tracks	No plans or estimate made

*For traffic in one direction only on each bridge.

-way traffic on each deck was used because it the following advantages:

Approach ramp system simplified.

Street approach ramps can be made one-way.

No center dividing strip required. (The minimum width for dividing strips is generally four feet. This would add materially to the cost of the structure, since the cost varies almost directly in proportion to the bridge width.)

Traffic not seriously affected if any one lane is blocked by an accident.

Head-on collisions eliminated.

-way traffic with a center dividing strip was ed for the upper deck of Location 7, as the stif- truss requirements of the 4,800-foot span ed a minimum bridge width of 100 feet. The -to-span ratio for suspension bridges should not ater than 1 to 50 for stability against wind loads ther lateral forces.

r the entire length of Location No. 8 and for the Bay portion of Location No. 9, which goes to the and Mole, it is proposed to use the new structure traffic going to San Francisco while the present e would be used for one-way traffic to Oakland. scheme has the same advantages as mentioned ously in connection with one-way traffic on the decks of one bridge.

For Locations 10 and 11, a four-lane divided high- was used on the upper deck and alternate truck railroad loadings were planned for the lower decks. Location 10A four vehicular lanes were provided ach deck. A width between truss centers of 66 feet selected, as this distance provided ample space all facilities. With slight modifications plans of East Bay structures of the San Francisco-Oakland Bridge could be used for crossings at these loca- . Fewer highway lanes are provided since traffic res (Ref. Section III) indicate that the amount of ic using new routing as compared with the present ge would be small.

ADES

The question of limiting grades is one of great rtance, especially when a structure handles mixed ic. It was considered necessary to limit the grade percent on that portion of the existing struc- which carried electric railway traffic. The maxi- grade for vehicles on the new layouts has been ted to 4 percent except in a few cases where heavier des were necessary. This will allow most vehicles to tain a satisfactory speed. The street approaches ing to the main structure on several locations have nding grades of 5 percent for shorter distances.

LOADING AND STRESSES

The preliminary bridge designs for these studies have been based on the design specifications of the American Association of State Highway Officials and the American Railway Engineering Association where applicable. These specifications do not apply to members whose designed strength is governed by a loading on span lengths greater than 400 feet. Previously-constructed, long-span bridges and the traffic requirements for each particular location are the best guide for determining loadings for spans over 400 feet. A list of the loadings and allowable stresses used in this study will be found in Appendix G.

Assuming the proposed bridge will not carry train traffic, the live loading will be somewhat lighter than the present bridge. (Plate V-2 shows this difference in loading.) The assumed live loading plus impact per lineal foot on the San Francisco-Oakland Bay Bridge was taken as 7,000 pounds while the new bridge will have a live loading of 6,200 pounds per foot.

Dead loads per foot of bridge for structures having the same main span lengths are slightly lower for the new structure than those of the San Francisco-Oakland Bay Bridge. Since the difference was within 2 percent, quantities were based directly on records of construction of the present bridge for estimating purposes.

Plate V-3 gives a summary of the railway loadings on the San Francisco-Oakland Bay Bridge and the loadings contemplated for the proposed bridges at Locations 10 and 11. The present bridge was designed for the abandoned Interurban Electric Railway, the cars of which had axle loadings of 35,000 pounds, but the Key System electric units which now operate over the bridge have maximum axle loads of 32,500 pounds. The spacings between axles and between truck centers are 6.5 and 45 feet respectively.

The bridges on Locations 10 and 11 have been designed for main line trains. The axle loadings for the heavier diesel and steam locomotives are twice as great as for electric passenger units, and the spacing between their axles is as close as 6.5 feet.

The standard design loading now used for bridges which carry steam trains is Cooper's E-72, which is portrayed at the bottom of Plate V-3. This theoretical engine has axle loads of 72,000 pounds on drivers spaced at five-foot centers. To the above loads must be added dynamic, vibratory, and impact effects which vary from 30 percent for interurban electric trains to 100 percent for steam locomotives. For short spans the design live loading plus impact stresses produced by the Cooper's E-72 locomotive can be 500 percent greater than those produced by electric trains and 750 percent greater than those produced by the heaviest legal truck.

Providing for such loads, especially if there are multiple tracks, adds materially to the cost of the steel superstructure and reflects to a lesser degree in the

cost of the substructure. In addition to the effect of these added loads, the ruling grades and horizontal curves needed for steam operation require much longer structures than are needed for handling vehicular traffic only.

It is possible that some savings could be made in the cost of the short span members of a structure if electric or diesel-electric motive power spread over more axles were used to draw trains across the Bay. However, this would be at great additional cost to the railroads for the purchase of new equipment; it would increase operating costs by requiring additional train crews; and it would result in a loss of time due to the changing of engines. It does not appear that the savings in cost of structure would be substantial enough to make up for the economic disadvantages and the loss of time.

The ratio of drawbar pull to locomotive weight is usually assumed to be 30 percent for diesel and 25 percent for steam locomotives. A minimum drawbar pull is required for any given grade. Therefore, it is not possible to reduce the total locomotive weight. Any saving due to the fact that diesel or electric locomotives may produce lower dynamic or impact stresses would be achieved primarily in floorbeams and stringers and the saving in the trusses would be practically negligible. The use of special motive power to operate over the new bridge would be costly and result in loss of time.

ELEVATIONS

Elevation 0.00 used in these studies is mean lower low water of the United States Coast and Geodetic Survey recorded at the Presidio tide staff. The elevation of mean lower low water on this staff is 5.50. This datum is the same as used for the San Francisco-Oakland Bay Bridge. Along the line of this bridge various bench marks have been established from which levels may be run. A table included in Appendix shows the relation between datums used in preparing the various maps and plates from which information was obtained. For information on local tides, currents and weather data, the reader is referred to the Hoover-Young Report. (Ref. 1.)

Cost Criteria

Not only does the cost of structural materials and labor vary with the locality and site conditions, but it also varies with business and general economic conditions. In the effort to foretell the cost of a structure at some future date, it is necessary to attempt to predict what the economic conditions will be at the time of construction. As in the case of any prediction of future conditions, it is necessary to study the trend of costs under known conditions during the past.

For the purpose of estimating the cost of items connected with these preliminary bridge layouts, cost indexes prepared by various organizations furnish a practical basis for comparison. The "Building Cost Index" prepared by *Engineering News-Record* is the one that appears most applicable to bridge construction. The components of this index are:

Structural steel shapes, base price x 25 cwt.
Cement at Chicago, price x 6 bbl.
2x4 S4S pine & fir, C.L. 20 cities, price x 1.088 M.B.M.
Skilled labor, 20 cities, ave. wage x 68.38 hrs.

The relative costs of these components follow more nearly the proportion of labor and material for a large steel bridge than do the components of indexes prepared by other organizations. The inclusion of skilled labor makes this index more appropriate than the *Engineering News-Record* "Construction Cost Index," which has the same components except that a common instead of skilled labor wage is used.

The quantities and costs of the contract items for the existing bridge afford a suitable basis for preliminary estimates of the cost of the second bridge, when modified to take care of present day knowledge and available equipment. The prices used to estimate the cost of a new bridge can be computed on the basis of relative cost indexes at the respective dates of letting contracts. Contracts for 90 percent of the cost of construction work (70 percent of the total cost of the present bridge exclusive of railroad facilities) were let in May, 1933, when the cost index was 143.9. The weighted average building cost index based on all the dates of awarding construction contracts is approximately 146.

The *Engineering News-Record* Cost Index from 1933 through 1946 is shown on Plate V-4. The last quarter of 1946 shows a leveling off of construction and building costs. It is doubtlessly true that present day prices are abnormally high because of scarcities and unsettled conditions, but an assumption that prices will not return permanently to the level of 1940 seems logical from the generally rising trend of the past. A prediction of the trend in cost for 1947 is given by the dotted line in this chart.

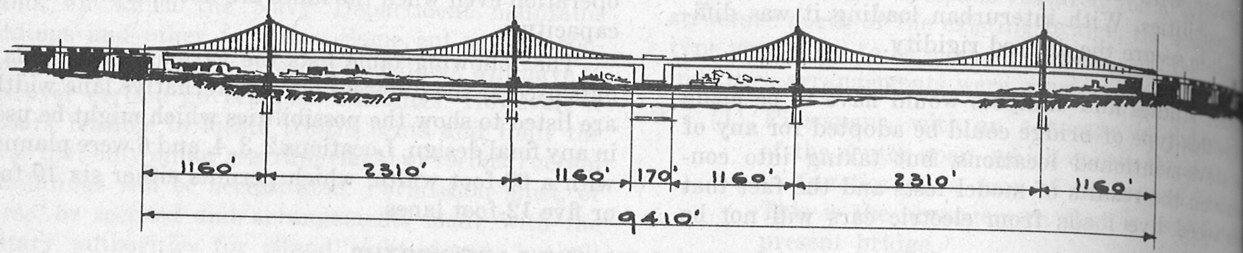
There are many factors in the cost of the first bridge which should not be reflected in the cost of a second structure, the principal factor being the uncertainty that existed with regard to the method and cost of foundation work and other unusual items of construction connected with a structure of this kind. It is evident that the experience gained in connection with the construction of the first bridge removed many of the uncertainties and should thereby reduce the contingency items in the contract prices for a second bridge

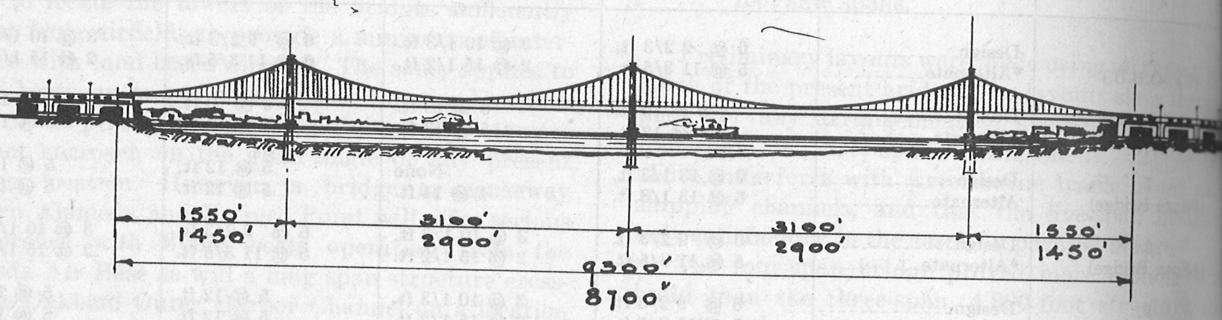
Plate V-1

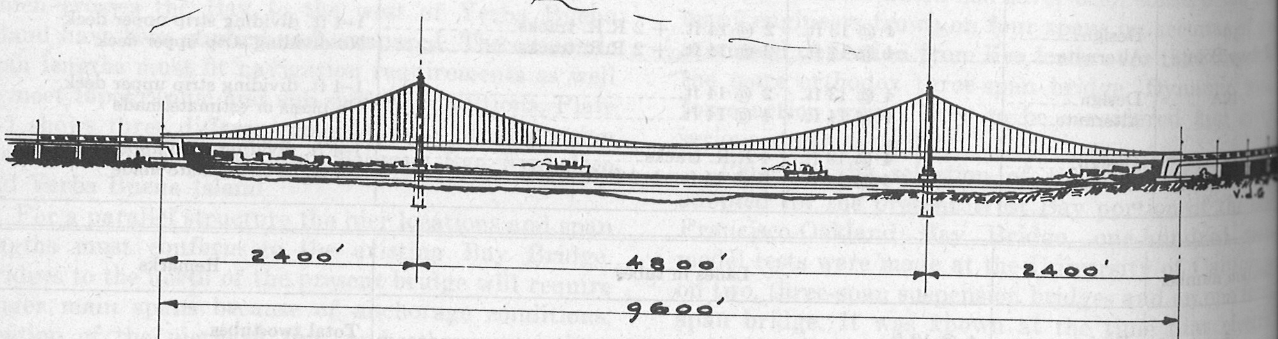
÷ TRANS BAY BRIDGE ÷

WEST BAY CROSSING

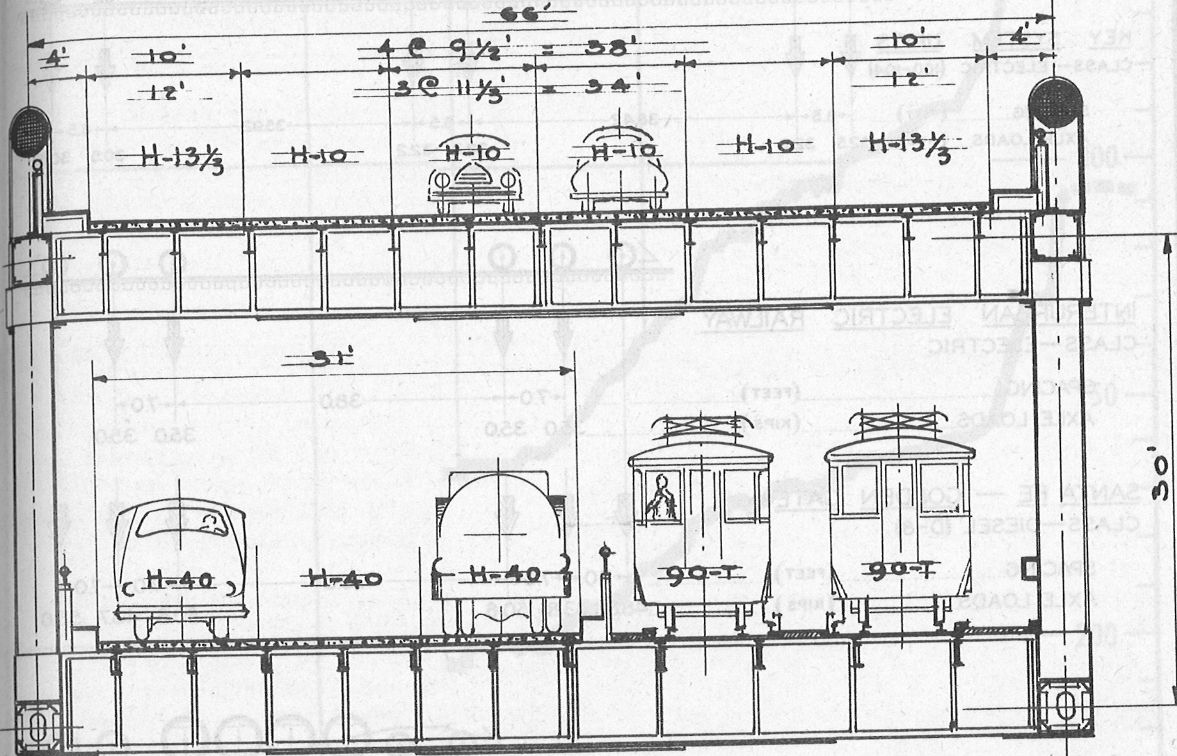
TYPES OF SUSPENSION BRIDGES



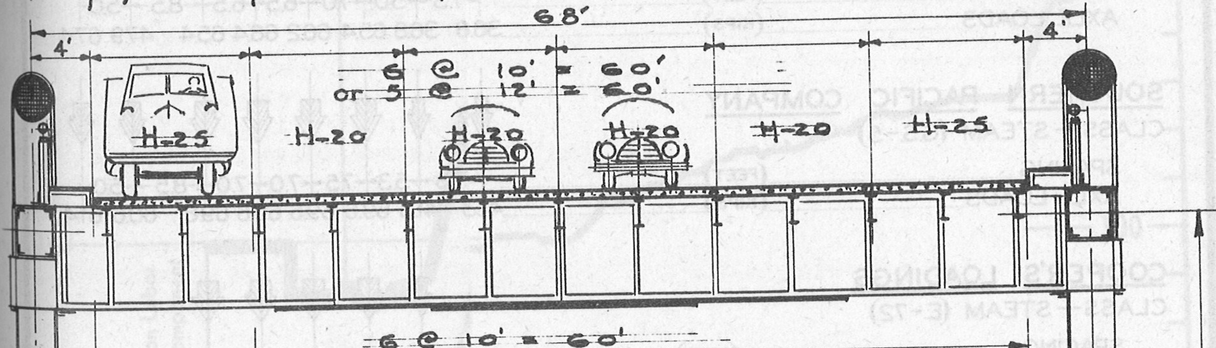




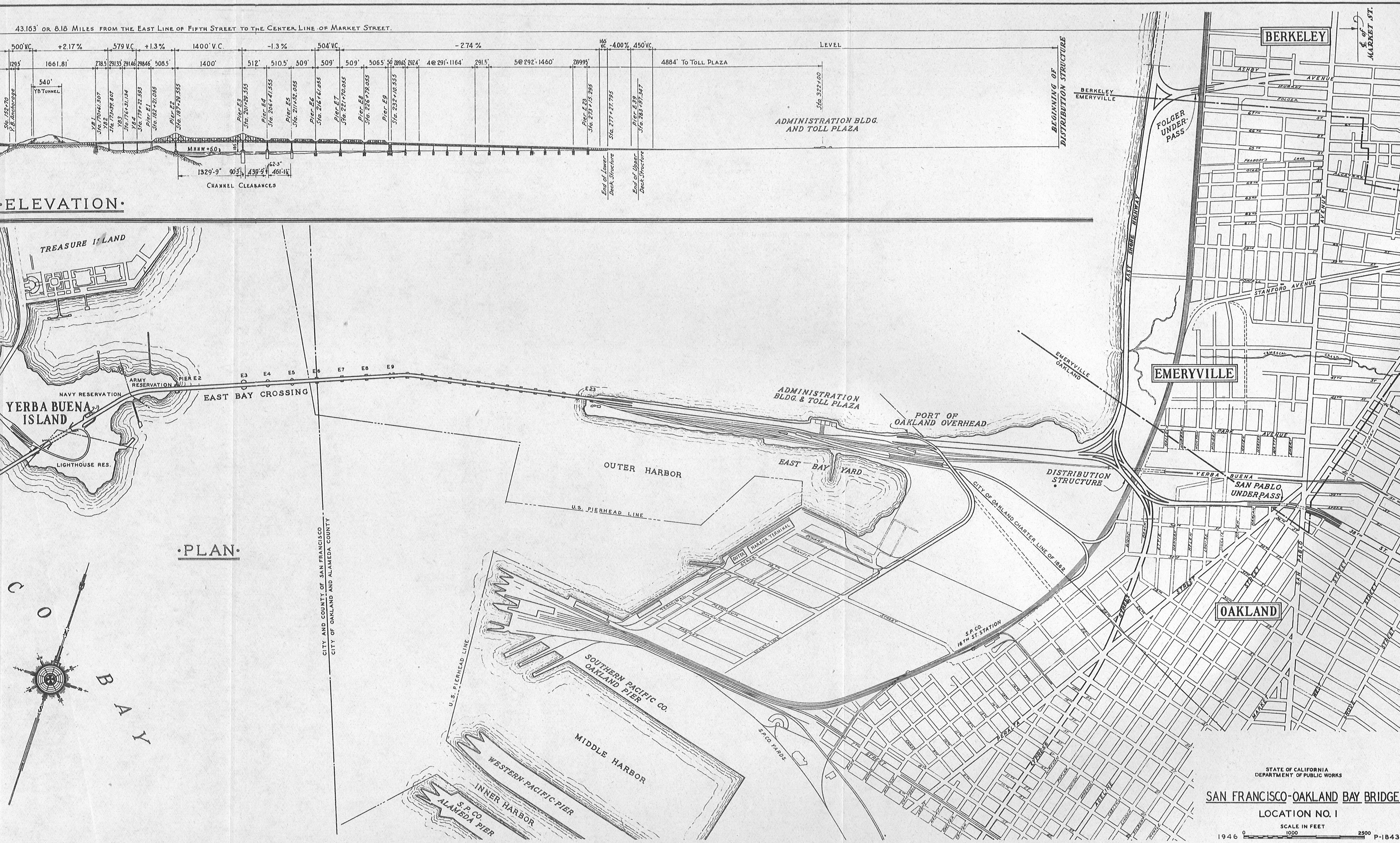
LIVE LOADINGS



SAN FRANCISCO ~ OAKLAND BAY BRIDGE.
Equivalent uniform live load + impact of 7000 pounds per foot length of bridge.



TRANS BAY BRIDGE
Equivalent uniform live load + impact of 6200 pounds per foot length of bridge.

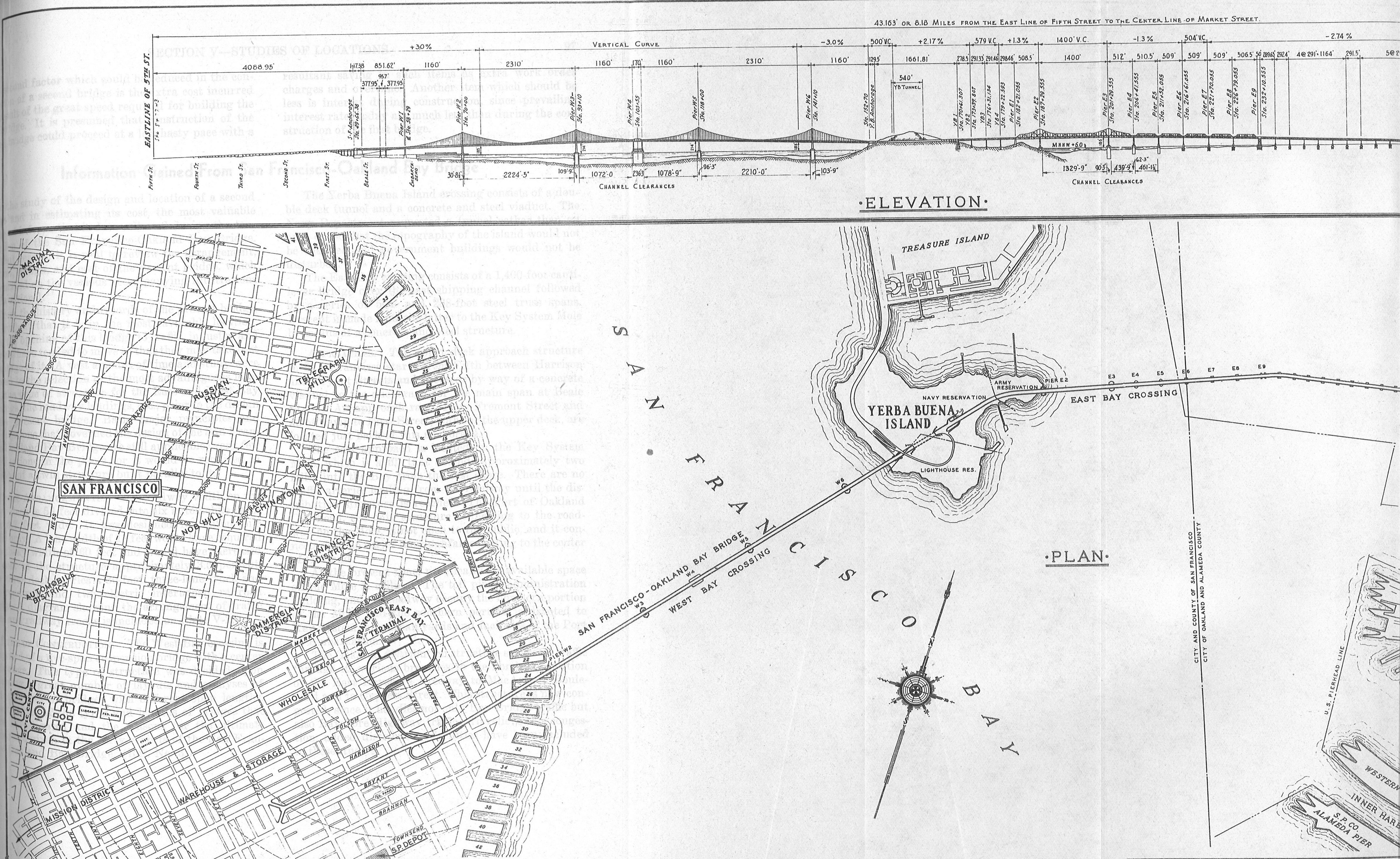


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

SAN FRANCISCO-OAKLAND BAY BRIDGE

LOCATION NO. 1

1946 SCALE IN FEET 0 1000 2500 P-1843-


43.163' OR 8.18 MILES FROM THE EAST LINE OF FIFTH STREET TO THE CENTER LINE OF MARKET STREET.
VERTICAL CURVE
CHANNEL CLEARANCES
·ELEVATION·
·PLAN·
SAN FRANCISCO BAY
SAN FRANCISCO
SAN FRANCISCO-OAKLAND BAY BRIDGE
WEST BAY CROSSING
EAST BAY CROSSING
SAN FRANCISCO-EAST BAY TERMINAL
YERBA BUENA ISLAND
TREASURE ISLAND
NAVY RESERVATION
ARMY RESERVATION
LIGHTHOUSE RES.
TELEGRAPH HILL
RUSSIAN HILL
NOB HILL
CHINATOWN
FINANCIAL DISTRICT
COMMERCIAL DISTRICT
AUTOMOBILE DISTRICT
MARINA DISTRICT
MISSION DISTRICT
WHOLESALE
WAREHOUSE & STORAGE
S.P. DEPOT
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
U.S. PIERHEAD LINE
S.P. CO. ALAMEDA PIER
INNER HARBOR
WESTERN

A second factor which could be reduced in the construction of a second bridge is the extra cost incurred as a result of the great speed required for building the first bridge. It is presumed that construction of the second bridge could proceed at a less hasty pace with a resultant saving in such items as extra work order charges and overtime. Another item which should be less is interest during construction, since prevailing interest rates today are much less than during the construction of the first bridge.

Information Gained From San Francisco-Oakland Bay Bridge

In the study of the design and location of a second bridge and in estimating its cost, the most valuable source of information is data collected during the construction of the San Francisco-Oakland Bay Bridge. For that reason, it is well to review the arrangement, location, design, and cost of the present bridge, which is identified on the various accompanying illustrations as "Location 1."

From the history and records of the present bridge, it is evident that it is in the most favorable location. Since the opening of this bridge to traffic, industry and business have tended to move so that they may take best advantage of it. A vast amount of time and study were devoted to the selection of the most advantageous location, the type of structure for the East and West Bay crossings, the roadway loadings, etc., prior to the design of the present bridge. Basic major principles and specifications that governed the design of the San Francisco-Oakland Bay Bridge are still applicable; very few modifications in the plans for it would be required in the case of a twin structure built parallel to it.

Deck Arrangements. The roadway width on the upper deck is 58 feet divided into six automobile lanes each 9.7 feet wide. It was designed for automobile traffic only. A lane width of 10 feet would have required a roadway width of 60 feet and would have increased the cost of the structure approximately 3.5 percent. The lower deck carries a 30-foot, three-lane truck and bus roadway and two electric interurban railroad tracks. A diagram showing the arrangement of traffic lanes and railway tracks is included on Plate V-2.

Type of Construction. The West Bay crossing is composed of a five-span suspension bridge with a center anchorage. This type of structure was decided upon following a great number of layouts and analyses of various types of bridges with different span lengths. Descriptions of the types and lengths of bridges that were investigated and the reasons for the ultimate choice are given in the early reports of the San Francisco-Oakland Bay Bridge. (Ref. No. 3.)

The Yerba Buena Island crossing consists of a double deck tunnel and a concrete and steel viaduct. The Navy Department requested a tunnel rather than an open cut so that the topography of the island would not be changed and government buildings would not be disturbed.

The East Bay crossing consists of a 1,400-foot cantilever bridge over the east shipping channel followed by a series of 504- and 288-foot steel truss spans. Descent is made from the latter to the Key System Mole by means of a concrete and steel structure.

Approaches. The upper deck approach structure in San Francisco starts from Fifth between Harrison and Bryant Streets and proceeds by way of a concrete viaduct to the anchorage for the main span at Beale Street. An approach ramp from Fremont Street and an off ramp to First Street, both for the upper deck, are located just back of this anchorage.

The east approach is located on the Key System Mole, which is a fill that extends approximately two miles into the Bay from the east shore. There are no traffic arteries leading from the roadway until the distribution structure is reached. The Port of Oakland Overhead, the only structure connecting to the roadway on the Mole, is not open to the public, and it connects with no major thoroughfares leading to the center of Oakland.

At the present time, practically all available space on the Mole is utilized. The toll plaza, administration building, and the roadway occupy the northern portion of the Mole, and the southern portion is devoted to Key System interurban yards and facilities of the Port of Embarkation.

The Oakland distribution structure separates traffic through its various branches to the northerly portion of the East Bayshore Freeway to MacArthur Boulevard and to Cypress Street. This structure is now congested, since it handles not only Bay Bridge traffic but also Bayshore Highway traffic. To relieve this congestion, added distribution facilities have been included in these studies.

TABLE V-1—GENERAL DESCRIPTION OF LOCATIONS STUDIED

Identifying "Location" number	San Francisco terminal area and connections	Notes	East Bay terminal area and connections
2	Telegraph Hill (Lombard Street)	Via Yerba Buena Island	Emeryville (Stanford Avenue)
3	Telegraph Hill (Broadway)	Traffic interchange on Yerba Buena Island. New structure straddles present bridge	Oakland Mole (East Bayshore Freeway)
4	Telegraph Hill (Lombard Street)	Traffic interchange on Yerba Buena Island. New structure straddles present bridge	South of Key System Mole Oakland (22d Street)
5	Rincon Hill, South of (Fourth Street)	Continuous curve of 32,800-ft. radius	Oakland Mole (Between 6th and 7th Sts.)
6	Telegraph Hill (South Side)	Traffic interchange on Yerba Buena Island. New structure straddles present bridge	Oakland Mole (East Bayshore Freeway)
7	Telegraph Hill (Broadway)	Via Yerba Buena Island	Key System Mole (North Side)
8	Rincon Hill	Via Yerba Buena Island	Key System Mole (North Side)
9	Rincon Hill	Traffic interchange on Yerba Buena Island. New structure straddles present bridge	Oakland Mole (East Bayshore Freeway)
10	Potrero Point		South Side Alameda (Webster and 6th Sts.)
10A	Potrero Point		South Side Alameda (Webster and 6th Sts.)
11	Hunter Point (Candlestick Point)		Bay Farm Island, Alameda (East Bayshore Freeway)
12	Potrero Point (Army Street)		South Side Alameda (Webster and 6th Sts.)

TABLE V-1—GENERAL DESCRIPTION OF LOCATIONS STUDIED—Continued

Identifying "Location" number	Type of structure	Type of traffic	Arrangement of lanes: Upper deck	Arrangement of lanes: Lower deck
	Four-span suspension bridge West Bay; Steel truss and cantilever spans East Bay	Vehicular only	Six 10-ft. or five 12-ft.	Six 10-ft. or five 12-ft.
	Four-span suspension bridge West Bay; Steel truss and cantilever spans East Bay	Vehicular only	Six 10-ft. or five 12-ft.	Six 10-ft. or five 12-ft.
	Four-span suspension bridge West Bay; Steel truss and cantilever spans East Bay	Vehicular only	Six 10-ft. or five 12-ft.	Six 10-ft. or five 12-ft.
	Two or four tubes	Vehicular only or combination rail-vehicular	Two 12-ft. lanes each tube, total four to eight lanes. Possible two rail tracks each tube but no plans or estimates made	
	Four-span suspension bridge West Bay; Steel truss and cantilever spans East Bay	Vehicular only	Six 10-ft. or five 12-ft.	Six 10-ft. or five 12-ft.
	Three-span suspension bridge West Bay; Steel truss and cantilever spans East Bay	Vehicular only	Six 13-1/5-ft. West Bay five 12-ft. East Bay	None or four 14-ft. West Bay five 12-ft. East Bay
	Entire bridge twin of present—300 ft. or more north	Vehicular only	Six 9-2/3-ft. or five 11-3/5-ft.	Three 10-1/3-ft. or two 15-½-ft.
	Bridge West Crossing twin of present; Steel truss and cantilever spans East Bay	Vehicular only	Six 9-2/3-ft. or five 11-3/5-ft. West Bay five 12-ft. East Bay	Three 10-1/3-ft. or two 15-½-ft. West Bay five 12-ft. East Bay
	Steel truss spans with cantilever structure across channel	Vehicular and steam railroad	Four 13-ft. or four 14-ft.	Two 14-ft. lanes and two railroad tracks
	Steel truss spans with cantilever structure across channel	Vehicular only	Four 13-ft. or four 14-ft.	Two 14-ft. or four 14-ft.
	Steel truss spans with lift span across channel	Vehicular and steam railroad	Four 13-ft. or four 14-ft.	Four railroad tracks or two 14-ft. lanes and two railroad tracks
	Mole, viaduct, and tube combination	Vehicular only or combination vehicular and steam railroad	Two 12-ft. lanes each tube. Total six or eight lanes. Possible two tracks one tube, but no plans or estimates made	

Specific Location Studies and Cost Estimates

Twelve different proposals, consisting of bridges and tubes across the Bay south of Yerba Buena Island and high-level bridges which cross the Bay via Yerba Buena Island, have been studied and are described in detail on the following pages.

In the cost estimates for various locations, certain minor items have been grouped together under the heading, "Miscellaneous Items of Work." This includes traffic signs and stripes, San Francisco and Oakland maintenance buildings, electrolysis protection, garages, etc., all of which pertain to the main structure. Similar items for the approaches are also lumped together.

Quantities and costs have been changed from those used on the original bridge to correspond with the conditions and requirements of the particular site. Contingencies have been included in the original items, but engineering has been added as a separate item, since it can be assumed to be a fixed percentage of the total cost.

Costs have been computed for each project built to its maximum capacity, but construction by stages could be employed for the bridge decks. For example, "Locations" 2, 3, 4, and 6 can be constructed with 36-foot roadways on both decks, and when needed these roadways could be widened to 60-feet.

It should be stated that while the specific "Locations" which cross Yerba Buena Island are complete and separate transbay crossings, other combinations of East and West Bay "Locations" than those shown in this study are possible and might prove desirable in the final analysis. For example, the West Bay crossing of "Location 6" might be combined with the East Bay crossing of "Location 8." The several different West Bay crossing proposals are essentially independent of the several East Bay crossing proposals, but the particular combinations described in the following "Location" studies cover most of the practicable combinations and Island crossing. From them, preliminary layouts and cost of other combinations can easily be obtained. It will be noted that the East and West Bay crossings are segregated in the cost estimates to facilitate the making of cost totals for other combinations.

The 12 specific proposals which are shown in this report are listed in Table V-1.

TELEGRAPH HILL (LOMBARD STREET) TO STANFORD AVENUE (EMERYVILLE)

LOCATION NO. 2—SEE PLATE V-9

On this structure westbound traffic (all types of vehicles) is carried on the upper deck and eastbound traffic on the lower deck, Cost estimates have been prepared for five lanes of traffic on each roadway.

WEST BAY CROSSING

This bridge is a four-span structure with two main spans each 3,100 feet long and side spans 1,550 feet long. This arrangement provides two wide channels for shipping. The anchorages are located in bedrock at Telegraph Hill and Yerba Buena Island.

The San Francisco terminal is located on the line of Lombard Street. Therefore, it would be advisable to change the route of the proposed tunnel, from Polk and Lombard Streets to Bay and Columbus Avenue (Ref. No. 7) so it will pass through Russian Hill along the line of Lombard Street. This would provide a direct route from the bridge end to Van Ness Avenue and the Golden Gate Bridge via Lombard Street, and could be connected with the proposed freeway along the water front. Ramps discharging traffic into San Francisco via Lombard Street, Columbus Avenue, and Mason Street are shown on the layout. Traffic going to the East Bay could approach the lower deck of the structure from almost any street in the vicinity of Lombard Street and Columbus Avenue, and a lower deck ramp is shown connecting the bridge with Columbus Avenue and Powell Street.

The crossing of Yerba Buena Island is made on a steel viaduct instead of through a tunnel. The viaduct is designed so that the bents will miss the larger government buildings underneath the structure.

EAST BAY CROSSING

The proposed East Bay crossing from Pier E-1 to Pier E-9 of the present bridge is parallel to and approximately 300 feet north of it. Along this portion of the bridge and also from Pier E-9 to E-23 the spans are similar to those of the present bridge, but the alignment starts to diverge opposite Pier E-9, the entire East Bay crossing being on a single tangent from Yerba Buena Island to the East Shore Highway.

Near the east shore line a ramp takes westbound traffic from the present San Francisco-Oakland Bay Bridge toll plaza to the upper deck of the proposed structure. A toll house and plaza is located on the fill to the north of the Key System Mole, and the present administration building serves for both bridges.

In order to make this layout workable, traffic congestion on the present distribution structure is relieved by connections to the Port of Oakland Overhead with a subway under the Southern Pacific tracks on the line of 22d Street. Connections at grade to the Eastshore Highway are shown, one arm for traffic between the proposed bridge and the north and the other arm connecting with the present distribution structure.

A viaduct over the Eastshore Highway and the main line of the Southern Pacific Company connects with Stanford Avenue in Emeryville. Stanford Avenue is a wide street, in the center of which is an industrial switching track to the vicinity of Adeline Street. From Stanford Avenue traffic can flow into numerous arterials, such as San Pablo Avenue, Ashby Avenue,

Broadway (State Route 75 leading to the Broadway Tunnel). This layout on the East Bay side may be considered as a modification of one that closely parallels the present bridge (Location No. 8); the choice between the two is largely a matter of effective traffic distribution throughout the same terminal area.

COST ESTIMATE

Description	*Cost*	
Borings and exploration	$150,000	
Substructure—West Bay	13,470,000	
Substructure—East Bay	7,530,000	
Superstructure—West Bay	32,250,000	
Superstructure—East Bay	16,200,000	
Yerba Buena units	3,350,000	
Final field painting	1,480,000	
San Francisco Section	1,110,000	
Port of Oakland overhead	1,800,000	
Stanford Avenue overhead	1,800,000	
Electrical work	600,000	
Building and toll plaza	240,000	
Miscellaneous items of work	420,000	
Total: Bridge construction	$80,400,000	
Engineering	4,000,000	
Total: Bridge		$84,400,000
22d Street underpass	$1,650,000	
Cypress Street separation	640,000	
San Francisco approaches, complete	1,310,000	
Oakland approaches, complete	3,940,000	
Approach lighting	500,000	
Miscellaneous items of work	120,000	
Total: Approach construction	$8,160,000	
Engineering	740,000	
Total: Legislative approaches		8,900,000
Property	$2,900,000	
Legal and insurance	1,000,000	
Interest	5,800,000	
Total: Noncontract items		9,700,000
GRAND TOTAL		$103,000,000

TELEGRAPH HILL (VICINITY OF BROADWAY) TO OAKLAND MOLE

LOCATION NO. 3—SEE PLATE V-15

On this bridge westbound traffic (all types of vehicles) is carried on the upper deck and eastbound traffic on the lower deck. Each roadway carries five lanes.

WEST BAY CROSSING

This is a four-span structure with two main spans each 2,900 feet long and side spans 1,450 feet long, which provides two wide channels for shipping. The anchorages are located in bedrock at Telegraph Hill and Yerba Buena Island.

A plaza is located near the entrance to the proposed tunnel on Broadway (Ref. No. 7), and is connected by ramps with the west end of the main bridge. The cable anchorage is located between Front and Davis Streets.

The westerly portion of Yerba Buena Island is crossed through a cut and by a series of steel spans on the easterly portion. The two decks of the steel spans are separated vertically a sufficient distance to permit the present San Francisco-Oakland Bay Bridge roadways to pass between. Upper deck interchange ramps for automobiles only are provided between the present and proposed bridges.

EAST BAY CROSSING

The crossing of the East Bay consists of steel spans with two 1,400-foot cantilever spans that provide clearance for the main channel and for the entrance to Oakland's Outer Harbor. A long steel viaduct is required along Seventh Street, Oakland, passing in front of Alber's Mill, continuing across the main line of the Southern Pacific, and reaching street grade west of Peralta Street. The bridge connects to the East Bayshore Freeway being built by the State.

The toll plaza, administration building, shops, and garages are located on the Oakland end of the structure.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure—West Bay	10,500,000	
(3)	Substructure—East Bay	12,900,000	
(4)	Superstructure—West Bay	25,800,000	
(5)	Superstructure—East Bay	27,000,000	
(6)	Yerba Buena units	4,800,000	
(7)	Final field painting	1,700,000	
(8)	San Francisco Section	710,000	
(9)	Electrical work	500,000	
(10)	Buildings and toll plaza	670,000	
(11)	Miscellaneous items of work	420,000	
	Total: Bridge construction	$85,300,000	
	Engineering	4,300,000	
	Total: Bridge		$89,600,000
(1)	San Francisco approaches, complete	$1,060,000	
(2)	Oakland approaches, complete	300,000	
(3)	Approach lighting	168,000	
(4)	Miscellaneous items of work	39,000	
	Total: Approach construction	$1,567,000	
	Engineering	133,000	
	Total: Legislative approaches		1,700,000
(1)	Property	$3,900,000	
(2)	Legal and insurance	1,000,000	
(3)	Interest	5,800,000	
	Total: Noncontract items		10,700,000
	GRAND TOTAL		$102,000,000

TELEGRAPH HILL (LOMBARD STREET) TO KEY MOLE (22ND STREET), OAKLAND

LOCATION NO. 4—SEE PLATE V-22

Westbound traffic (all types of vehicles) is carried on the upper deck and eastbound traffic on the lower. Each roadway has five lanes. This location has five miles of tangent alignment starting in the vicinity of Jones and Lombard Streets in San Francisco and terminating near the present toll plaza on the south side of the Key System Mole.

WEST BAY CROSSING

The bridge is a four-span structure with two main spans each 3,100 feet long and side spans 1,550 feet long, which provides two wide channels for shipping. The anchorages are located in bedrock at Telegraph Hill and Yerba Buena Island.

The terminal in San Francisco being on the line of Lombard Street, the remarks covered under Location No. 2 also apply here. Ramps terminate in the vicinity of Mason and Columbus Avenue for downtown traffic and trucks turn to the right and use Bay Street and the Embarcadero to arrive at their destination.

The island crossing, like that of Location No. 3, is through a cut and over a viaduct. A complete interchange of upper deck automobile traffic is possible on the island. Trucks would be restricted from using this interchange, since the upper deck of the present bridge was not designed to carry trucks.

Vehicular interchange movements on the lower deck of the present bridge across the Key System tracks would, of course, be prohibited.

EAST BAY CROSSING

The East Bay crossing structure is similar to and a short distance south of the San Francisco-Oakland Bay Bridge. It reaches grade on the south side of the present Key System Mole. The toll plaza for the new bridge is opposite the present toll house, to which it is connected by a pedestrian underpass. One toll house serves for both projects.

A complete interchange of westbound traffic is made east of the toll plaza by altering the present Port of Oakland Overhead. This gives motorists the choice of either bridge and would eliminate any traffic crossing at grade.

A subway is required on the line of 22d Street crossing under the Southern Pacific Company's storage yard and main line tracks, and a separation is necessary at the 22d Street intersection with Peralta and Cypress Streets. Connection is made at this point to the proposed East Bayshore Freeway.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$150,000	
(2)	Substructure—West Bay	12,600,000	
(3)	Substructure—East Bay	7,500,000	
(4)	Superstructure—West Bay	29,700,000	
(5)	Superstructure—East Bay	15,900,000	
(6)	Yerba Buena units	4,500,000	
(7)	Final field painting	1,400,000	
(8)	San Francisco section	1,200,000	
(9)	Port of Oakland overhead	600,000	
(10)	22d Street underpass	1,600,000	
(11)	Cypress Street separation	640,000	
(12)	Electrical work	600,000	
(13)	Buildings and toll plaza	250,000	
(14)	Miscellaneous items of work	460,000	
	Total: Bridge construction	$77,100,000	
	Engineering	3,800,000	
	Total: Bridge		[illegible]
(1)	San Francisco approaches, complete	$1,300,000	
(2)	Oakland approaches, complete	1,800,000	
(3)	Approach lighting	210,000	
(4)	Miscellaneous items of work	90,000	
	Total: Approach construction	$3,400,000	
	Engineering	300,000	
	Total: Legislative approaches		[illegible]
(1)	Property	$4,000,000	
(2)	Legal and insurance	900,000	
(3)	Interest	5,500,000	
	Total: Noncontract items		[illegible]
	GRAND TOTAL		[illegible]

SOUTH OF RINCON HILL TO OAKLAND MOLE (TUBES)

LOCATION NO. 5—SEE PLATE V-27

At Location No. 5 a bridge was investigated but found impracticable because of poor foundation conditions and the hazards to navigation and aviation that would result from such a structure.

The study amplifies that made in connection with the Hoover-Young Report. Studies were made of two tubes, each with a 24-foot roadway, and each carrying auto, bus, and truck traffic in one direction only. It is to be noted that this provides a total of only four traffic lanes compared with eight or ten lanes on the various bridge proposals.

A tube crossing the Bay at this location is possible and would provide the shortest Bay crossing. The San Francisco terminal for the proposed tubes is located at a point midway between Bryant and Brannan Streets on Fourth Street. From this point the tubes follow a continuous 32,000-foot radius curve to an East Bay

located between Sixth and Seventh Streets at Street in Oakland. The total length of the project is 31,850 feet, or six miles; portal-to-portal length 0 feet or five and one-eighth miles.

DESIGN

The tubes are built of reinforced concrete in sections feet long, 38 feet in external diameter, with 36-inch For the greater portion of the crossing the sections would be floated into position and landed on piers. The crown of the tube in navigable water is 53 feet below mean lower low water and 51 feet below the lowest tide.

In San Francisco there is a ventilation building on the west side of Second Street. East of this building 3,500 feet of both cast-in-place and floated sections are required in descending to the elevation needed for navigational clearance. A second ventilation building on the San Francisco side is required at the outer end of Pier 30. In all, 83 twin-tube sections are needed to reach the first Oakland ventilation building, which is located adjacent to the Southern Pacific Company mole inside the pier-head line. An additional 7,600 feet of both floated and cast-in-place tube sections lead to the fourth and most easterly ventilation building. This portion of the tube must pass under many railroad tracks and heavy warehouse buildings.

VENTILATION

Due to the length of tube between portals, a special type of combined longitudinal and transverse ventilation system has been developed which eliminates the need for placing ventilation buildings within navigable waters. A longitudinal ventilation system is used in the long portion between pier-head lines. The roadway portion of the tube cross-section provides sufficient area for the delivery of fresh air at relatively low velocity from the pier-head ventilators to the center of the crossing. At this point vitiated air is collected through floor gratings and returned by forced pressure and high velocities through smaller ducts under the roadway slab to the exhaust stacks of the ventilator buildings. This is effected by a series of booster fans spaced at intervals along the tube.

In the tubes at the shore ends, transverse type ventilation is effected by means of the first and fourth ventilators and suitable bypasses at the pier-head line shafts provide supplementary ventilation for the tubes of the water crossing.

APPROACHES

In San Francisco, Welsh, and Freelon Streets carry one-way traffic between Fourth and Fifth Streets. The approaches flare between Bryant and Brannan Streets from the transition section at Third Street. Since Third Street carries heavy vehicular and streetcar traffic to the Southern Pacific Depot at Third and Townsend Streets, a Third Street crossing over the depressed portion of the tube approach is required. Toll collection facilities are at the Oakland terminus of the crossing and the ventilation building could be used as an administration office building as well. The East Bayshore Freeway would connect with these tubes, and the problem of traffic would be similar to the case of an Oakland Mole terminus.

The estimated first cost for this proposal is higher than that of any of the other 11 crossings considered. Moreover, the tubes would require $500,000 more per year for operation and maintenance over the present bridge budget.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure	8,700,000	
(3)	Tube	90,000,000	
(4)	Buildings	21,700,000	
(5)	Mechanical equipment	9,900,000	
(6)	Electrical work	5,700,000	
(7)	Administration building and toll plaza	600,000	
(8)	Railroad work	680,000	
(9)	Miscellaneous items of work	1,420,000	
	Total: Tube construction	$139,000,000	
	Engineering	9,700,000	
	Total: Tube		$148,700,000
(1)	San Francisco approach, complete	$960,000	
(2)	Oakland approach, complete	1,160,000	
(3)	Approach lighting	110,000	
(4)	Third Street separation	300,000	
(5)	Miscellaneous items of work	40,000	
	Total: Approach construction	$2,570,000	
	Engineering	230,000	
	Total: Legislative approaches		2,800,000
(1)	Property	$4,500,000	
(2)	Legal and insurance	1,500,000	
(3)	Interest	9,500,000	
	Total: Noncontract items		15,500,000
	GRAND TOTAL		$167,000,000

TELEGRAPH HILL (WASHINGTON SQUARE) TO OAKLAND MOLE

LOCATION NO. 6—SEE PLATE V-30

Westbound traffic (all types of vehicles) on this bridge is carried on the upper deck and eastbound traffic on the lower deck. Each roadway has five lanes.

WEST BAY CROSSING

This bridge is four-span suspension structure with two main spans each 2,900 feet long and side spans 1,450 feet long. This provides two wide channels for shipping. The cable achorages are located in bed rock at Telegraph Hill and Yerba Buena Island.

The terminus in San Francisco has a short approach structure and the alignment provides one of the shorter West Bay crossings. Traffic to the west would use the proposed Broadway Tunnel. The upper deck of the bridge discharges its traffic at Washington Square on Columbus Avenue. The lower deck receives traffic one block east of Washington Square in the vicinity of Union, Filbert, and Stockton Streets. The approach spans connect with the structure at Sansome Street.

The Yerba Buena crossing is similar to that shown for Locations 3 and 4, which provide for the interchange of automobile traffic only. These interchanges are arranged to permit motorists to use either bridge.

EAST BAY CROSSING

The East Bay structure is identical to that of Location No. 3 and reference is made to that discussion.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure—West Bay	10,300,000	
(3)	Substructure—East Bay	12,900,000	
(4)	Superstructure—West Bay	26,100,000	
(5)	Superstructure—East Bay	26,900,000	
(6)	Yerba Buena units	5,100,000	
(7)	Final field painting	1,800,000	
(8)	San Francisco section	740,000	
(9)	Electrical work	500,000	
(10)	Buildings and toll plaza	760,000	
(11)	Miscellaneous items of work	400,000	
	Total: Bridge construction	$85,800,000	
	Engineering	4,300,000	
	Total: Bridge		$90,100,000
(1)	San Francisco approaches, comp.	$420,000	
(2)	Oakland approaches, complete	290,000	
(3)	Approach lighting	150,000	
(4)	Miscellaneous items of work	34,000	
	Total: Approach const.	$894,000	
	Engineering	106,000	
	Total: Legislative approaches		1,000,000
(1)	Property	$3,300,000	
(2)	Legal and insurance	900,000	
(3)	Interest	5,700,000	
	Total: Noncontract items		9,900,000
	GRAND TOTAL		$101,000,000

TELEGRAPH HILL (VICINITY OF BROADWAY) TO KEY SYSTEM MOLE

LOCATION NO. 7—SEE PLATE V-34

WEST BAY CROSSING

Since this location resulted in the shortest [illegible] crossing of the West Bay, a single simple suspension structure with a main span of 4,800 feet and side spans of 2,400 feet was selected for study. It would be the longest bridge of its type in existence, since the longest built to date is the 4,200-foot main span of the Golden Gate Bridge. To give a reasonable width-to-span ratio for this bridge, a center-to-center spacing of 100 feet was used for the stiffening trusses. Four main cables were used instead of the customary two. Hangers are spaced 60 feet apart, as this distance proves most economical for the floor system. The upper deck would have two 40-foot roadways (three lanes in each direction) with a four-foot dividing strip and would carry all types of vehicles. Broad curbs could be utilized as turnout bays for stalled cars.

The San Francisco approaches are identical to those described for Location No. 3, and reference is made to that discussion. However, in this case, the anchorages would be in the vicinity of Sansome and Vallejo Streets. The anchorages for the main cables are in bedrock at both the San Francisco and Yerba Buena Island ends. The main span pier on the San Francisco end is located at the end of Harbor Pier No. 11.

A transition section in the cut on Yerba Buena Island provides a connection between the single-deck West Bay structure and the double-deck East Bay structure. No traffic interchange with the San Francisco-Oakland Bay Bridge is provided on the Island.

The high estimated cost for this project ($134,[illegible]000) is due primarily to the 4,800-foot suspension bridge. If a West Bay structure similar to the four-span structure shown for Location No. 3 were used, this project would cost approximately $93,000,000, [illegible] percent more than the "parallel" bridge, Location No. 8. It is apparent, therefore, that the use of such a long span cannot be justified.

EAST BAY CROSSING

Traffic (all types of vehicles) on the upper deck of the East Bay crossing goes to Oakland and on the lower deck to San Francisco. The East Bay crossing structure would be similar to that of the San Francisco-Oakland Bay Bridge, with alignment approximately parallel and 300 feet to the north of it. At the west end of the Key System Mole a complete interchange of upper and lower deck traffic can be made, which gives motorists the choice of either bridge to San Francisco.

Toll plazas on the north and south sides of the present Administration Building each handle west and eastbound traffic respectively. This requires that the

southbound ramp of the Port of Oakland Overhead be realigned to meet the north roadway.

In order to reduce the volume of traffic on the distribution structure, 22d Street is extended to connect with this overhead, and a 22d Street subway under the Southern Pacific tracks and Peralta and Cypress Street separations is required. A separation structure over the East Shore Highway and the Southern Pacific Powell Street tracks, which has been given consideration in the report, is very desirable, but the cost of this structure is not included in the cost estimate for Location No. 7.

COST ESTIMATE

Item	Description	Cost	
(1)	Borings and exploration	$150,000	
(2)	Substructure—West Bay	13,000,000	
(3)	Substructure—East Bay	7,600,000	
(4)	Superstructure—West Bay	63,700,000	
(5)	Superstructure—East Bay	17,900,000	
(6)	Yerba Buena units	2,800,000	
(7)	Field painting	1,500,000	
(8)	San Francisco section	870,000	
(9)	Electrical work	600,000	
(10)	Building and toll plaza	340,000	
(11)	Miscellaneous items of work	440,000	
	Total: Bridge construction	$108,900,000	
	Engineering	5,400,000	
	Total: Bridge		$114,300,000
(1)	San Francisco approaches, complete	$820,000	
(2)	Oakland approaches, complete	2,200,000	
(3)	Approach lighting	80,000	
(4)	22d Street underpass	1,600,000	
(5)	Cypress Street separation	640,000	
(6)	Mole overhead	750,000	
(7)	Port of Oakland overhead	120,000	
(8)	Miscellaneous items of work	110,000	
	Total: Approach construction	$6,320,000	
	Engineering	580,000	
	Total: Legislative approaches		6,900,000
(1)	Property	$3,900,000	
(2)	Legal and insurance	1,200,000	
(3)	Interest	7,700,000	
	Total: Noncontract items		12,800,000
	GRAND TOTAL		$134,000,000

RINCON HILL TO KEY SYSTEM MOLE PARALLEL TO BAY BRIDGE

LOCATION NO. 8—SEE PLATE V-39

A bridge on this location essentially is a duplicate of the present San Francisco-Oakland Bay Bridge and 325 feet north of the present West Bay crossing. One pier is at the end of Harbor Pier 22, and the same span arrangement for the West Bay crossing would be used. The East Bay crossing is 300 feet north of the present alignment in order to fit the Toll Plaza layout.

The West Bay, Yerba Buena Island, and East Bay crossings are the same as for the present bridge except that the tunnel on the Island is 900 feet in length instead of 540 feet. The West Bay piers descend to a lower elevation than those of the present bridge.

The twin bridges operate as follows:

	San-Francisco-Oakland Bay Bridge	*Parallel Bridge*
Upper Deck:	Automobiles, five lanes to Oakland	Automobiles, five lanes to San Francisco
Lower Deck:	Trucks and busses, three lanes, to Oakland. Electric trains	Trucks and busses, three lanes, to San Francisco. Five lanes ultimate

In San Francisco traffic leaves and approaches the structure at Fifth, First, Fremont, and Essex Streets. Connections would be made to the West Bayshore Freeway at Fifth Street for through traffic. Proposed connections for traffic going north of Market Street are shown as dotted lines on Plate V-43. On and off ramps are also provided at Eighth Street. An upper deck "off ramp" is built over the present upper deck "on ramp" along Essex Street, Plate V-44. The upper deck "on ramp" takes its traffic from First Street, which is a one-way southbound street, and the upper deck from the new bridge could discharge downtown traffic at Fremont Street. The "on ramp" is changed to First Street to conform with traffic movements.

It is necessary to relocate the roads now connecting to Treasure Island, and accelerating and decelerating lanes are added at the intersections of these roads with the bridges.

The alignment on the Key System Mole, Plate V-48, with the exception of the interchange ramp, are the same as for Location No. 7.

COST ESTIMATE

Item	Description	Cost	
(1)	Borings and exploration	$150,000	
(2)	Substructure—West Bay	13,800,000	
(3)	Substructure—East Bay	7,500,000	
(4)	Superstructure—West Bay	21,700,000	
(5)	Superstructure—East Bay	13,900,000	
(6)	Yerba Buena units	3,900,000	
(7)	Final field painting	1,400,000	
(8)	San Francisco section	1,260,000	
(9)	Electrical work	600,000	
(10)	Buildings and toll plaza	280,000	
(11)	Miscellaneous items of work	310,000	
	Total: Bridge construction	$64,800,000	
	Engineering	3,200,000	
	Total: Bridge		$68,000,000
(1)	San Francisco approaches, complete	$940,000	
(2)	Oakland approaches, complete	2,100,000	
(3)	Approach lighting	180,000	
(4)	22d Street underpass	1,600,000	
(5)	Cypress Street separation	640,000	
(6)	Port of Oakland overhead	120,000	
(7)	Miscellaneous items of work	120,000	
	Total: Approach construction	$5,700,000	
	Engineering	500,000	
	Total: Legislative Approaches		6,200,000
(1)	Property	$4,300,000	
(2)	Legal and insurance	800,000	
(3)	Interest	4,700,000	
	Total: Noncontract Items		9,800,000
	GRAND TOTAL		$84,000,000

RINCON HILL TO OAKLAND MOLE

LOCATION NO. 9—SEE PLATE V-49

The West Bay crossing is the same as for Location No. 8, being parallel and 325 feet to the north of the present bridge, but the East Bay crossing connects with the Southern Pacific Company Mole in Oakland. The same type of East Bay structure as used for Location No. 3 would be employed.

The two bridges may operate as follows:

	San Francisco-Oakland Bay Bridge	New Bridge
West Bay		
Upper Deck:	Automobiles, five lanes, to Oakland	Automobiles, five lanes, to San Francisco
Lower Deck:	Trucks and busses, three lanes, to Oakland	Trucks and busses, five lanes, to San Francisco
East Bay		
Upper Deck:	Automobiles, six lanes, both directions	Automobiles, six lanes, both directions
Lower Deck:	Trucks, three lanes, both directions	Trucks and busses, four lanes, both directions

Full interchange between bridges for both the upper and lower decks is made at Yerba Buena Island for traffic originating in San Francisco. The roadways for westbound traffic are so arranged that the two West Bay structures operate as one-way bridges for both upper and lower deck vehicles.

At Fifth Street in San Francisco, the traffic on the upper deck of the structure connects with the West Bayshore Freeway and other arteries as discussed under Location No. 8.

The East Bay crossing to the Southern Pacific Mole and the viaduct to Peralta Street are described under Location No. 6. An interchange structure at the toll plaza is necessary in order to keep traffic flowing through the proper gates.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure—West Bay	13,800,000	
(3)	Substructure—East Bay	12,900,000	
(4)	Superstructure—West Bay	21,700,000	
(5)	Superstructure—East Bay	25,900,000	
(6)	Yerba Buena units	6,900,000	
(7)	Final field painting	1,800,000	
(8)	San Francisco section	1,200,000	
(9)	Electrical work	550,000	
(10)	Buildings and toll plaza	740,000	
(11)	Miscellaneous items of work	310,000	
	Total: Bridge construction	$86,100,000	
	Engineering	4,300,000	
	Total: Bridge		$90,400,000
(1)	San Francisco approaches, complete	$920,000	
(2)	Oakland approaches, complete	310,000	
(3)	Approach lighting	200,000	
(4)	Miscellaneous items of work	40,000	
	Total: Approach construction	$1,470,000	
	Engineering	130,000	
	Total: Legislative approaches		1,6[illegible]
(1)	Property	$4,300,000	
(2)	Legal and insurance	900,000	
(3)	Interest	5,800,000	
	Total: Noncontract items		11,0[illegible]
	GRAND TOTAL		$103,0[illegible]

POTRERO POINT (VICINITY OF 20TH STREET) TO ALAMEDA VEHICULAR AND RAILROAD

LOCATION NO. 10—SEE PLATE V-55

The main portion of the water crossing on this lo[cation] consists of steel truss spans with a cantilever br[idge] providing a channel span 1,400 feet long. The br[idge] carries four vehicular lanes on the upper deck [and] two truck lanes and two steam railroad tracks on the lower deck.

This proposal is studied in conjunction with Location No. 10A in order to determine the additional [cost] for railroad facilities on the structure.

The length of this bridge is 31,700 feet or six mi[les]. A short fill is required at the Alameda end on wh[ich] the toll plaza and gates are located.

The San Francisco terminal is on the line of 2[0th] Street and connects with the West Bayshore Freew[ay]. The Alameda terminal is at the foot of Webster Stre[et].

In San Francisco, a forked tunnel through Potr[ero] Hill is needed for railroad and for vehicular traffic. T[he] east end of this tunnel is double-decked for the tw[o] types of traffic. Truck traffic on the lower deck com[es] to grade at Tennessee Street, and suitable connectio[ns] to Third Street, one block to the east, are provided.

On the East Bay side there is a transition sec[tion] which brings the upper and lower deck vehicular tra[ffic] down to the mole fill.

In order to complete this project for vehicu[lar] traffic, it is necessary to include in the estimate th[e] cost of an additional Oakland Estuary Tube.

Connections with existing railroads are made [at] Seventh and Townsend Streets in San Francisco an[d] with the Southern Pacific's Lincoln Avenue Line [in] Alameda. It is realized that for passenger traffic a mo[re] direct connection should be made across the Estuary to the termini of the three transcontinental railroads.

The minimum grade obtainable between the end [of] the high level portion of the bridge and the existin[g] railroad facilities in the vicinity of Townsend Stre[et]

San Francisco is 1.3 percent. To obtain a flatter grade the bridge terminus must be moved farther south which would increase the cost of the approaches considerably. Two railroad tracks, which provide only for passenger train traffic, are shown on the structure, since it is believed that this location can serve only railway passenger and express traffic. The location of freight yards in the vicinity of the terminals is impractical.

COST ESTIMATE

Item	Description	Cost	
	Borings and explorations	$300,000	
	Substructure	18,600,000	
	Superstructure	36,000,000	
	Final field painting	1,900,000	
	San Francisco section	260,000	
	Electrical work	700,000	
	Railroad viaduct	10,200,000	
	Railroad tunnel	1,800,000	
	Railroad ballasted track	120,000	
	Railroad bridge track	2,400,000	
	Buildings and toll plaza	610,000	
	Miscellaneous items of work	410,000	
	Total: Bridge construction	$73,300,000	
	Engineering	5,200,000	
	Total: Vehicular and railroad bridge		$78,500,000
	San Francisco approaches, complete	$480,000	
	Alameda approaches, complete	1,950,000	
	Approach lighting	150,000	
	San Francisco tunnel	2,700,000	
	Bayshore freeway separation	1,000,000	
	Estuary tube crossing	6,600,000	
	Webster street underpass	700,000	
	Miscellaneous items of work	120,000	
	Total: Approach construction	$13,700,000	
	Engineering	1,300,000	
	Total: Legislative approaches		15,000,000
	Property	$6,800,000	
	Legal and insurance	1,100,000	
	Interest	6,600,000	
	Total: Noncontract items		14,500,000
	GRAND TOTAL		$108,000,000

The cost estimates shown are for connection to existing railroad facilities on each end of the project only and do not include the many additional items that would be necessary to fully complete the railroad layout. Some of these items which are not included but which would be necessary in any long range program are shown under the discussion of Location No. 11 (Hunter Point-Bay Farm Island). However, the freight facilities mentioned for Location No. 11 would not be applicable for this Potrero Point-Alameda bridge.

POTRERO POINT (VICINITY OF 20TH STREET) TO ALAMEDA VEHICULAR TRAFFIC ONLY

LOCATION NO. 10A—SEE PLATE V-55

This layout is identical to that of Location No. 10 except that in this proposal the two steam railroad tracks have been omitted and the lower deck has been paved for trucks and busses. The difference between the estimates for Locations 10 and 10A represents the cost for railroad facilities. As in Location No. 10, an *additional* Oakland Estuary tube as well as a Webster Street Undercrossing was included in the cost to complete the project. This would provide a total of four lanes of traffic into Oakland whereas the bridge will have eight. Local traffic is sufficient to fill both of these tubes to capacity, and it appears that other distribution arteries would be required.

The vehicular approaches and connections at each end of the bridge structure are identical to those for Location No. 10. Although two roadways were considered in the estimate, traffic figures indicate that one four-lane roadway would be sufficient for the present.

COST ESTIMATE

Item	Description	Cost	
(1)	Borings and exploration	$300,000	
(2)	Substructure	17,600,000	
(3)	Superstructure	32,000,000	
(4)	Final field painting	1,500,000	
(5)	San Francisco section	250,000	
(6)	Electrical work	700,000	
(7)	Buildings and toll plaza	610,000	
(8)	Miscellaneous items of work	440,000	
	Total: Bridge construction	$53,400,000	
	Engineering	3,800,000	
	Total: Vehicular bridge		$57,200,000
(1)	San Francisco approaches, complete	$480,000	
(2)	Alameda approaches, complete	1,750,000	
(3)	Approach lighting	150,000	
(4)	San Francisco tunnel	2,700,000	
(5)	Bayshore freeway separation	1,000,000	
(6)	Estuary Tube crossing	6,600,000	
(7)	Webster Street underpass	700,000	
(8)	Miscellaneous items of work	120,000	
	Total: Approach construction	$13,500,000	
	Engineering	1,200,000	
	Total: Legislative approaches		14,700,000
(1)	Property	$5,500,000	
(2)	Legal and insurance	800,000	
(3)	Interest	4,800,000	
	Total: Noncontract items		11,100,000
	GRAND TOTAL		83,000,000

HUNTER POINT (CANDLESTICK POINT) TO BAY FARM ISLAND, ALAMEDA VEHICULAR AND RAILROAD TRAFFIC

LOCATION NO. 11—SEE PLATE V-61

This crossing is the farthest south of any chosen for study and connects Candlestick Point (which is in the Hunter Point general area), with Bay Farm Island, Alameda. Since present traffic counts indicate that the amount of vehicular traffic using this route would be relatively small, only four lanes for vehicles, two in each direction, are provided. The entire lower deck is devoted to passenger and freight railroad traffic for which four tracks are provided.

The structure across the bay has concrete approach spans, 292-foot and 509-foot steel truss spans, and a 500-foot vertical lift bridge over the main channel. The clear horizontal opening is 450 feet and the vertical clearance 70 feet in the closed and 140 feet in the raised position.

RAILROAD FACILITIES

Both freight and passenger railroad traffic is provided for in this case as it would be possible to acquire land for coach and freight yards on each end of the structure at a reasonable price, *but the cost of such land or yards is not included in the following estimate.* Provisions are made on the west side for railroad connections both north and south of the Southern Pacific Company's tunnel Number 4. The Western Pacific and Santa Fe would operate over joint trackage with the Southern Pacific north of the bridgehead, to the connections with their own trackage. In Oakland, a connection between the Western Pacific and the Santa Fe, now under consideration, would provide north and south connections for all of the East Bay railroads. In order to eliminate crossovers and complicated main line connections, the Western Pacific and Santa Fe occupy the two center tracks on the bridge. The Southern Pacific connection from the bridge to points South goes over the East Bayshore Freeway.

VEHICULAR FACILITIES

A complete vehicular grade separation structure is provided at Blanken Street and at this point all movements onto and off of the proposed bridge are made. Westbound traffic from the bridge then has the choice of entering San Francisco by either the proposed West Bayshore Freeway, Third Street, Bayshore Boulevard, or San Bruno Avenue.

The toll plaza, garage and tow service station, and administration building are located on the westerly side of Bay Farm Island.

Maitland Drive, which crosses Bay Farm Island, is depressed under the proposed bridge railroad and highway. Grade connections to Maitland Drive are made at this crossing for routings to Alameda and the Oakland Municipal Airport. Both vehicular and rail facilities cross Bay Farm Island on embankments.

A double-deck structure is required to cross the airport channel leading to San Leandro Bay and a bascule span with a 100-foot clear opening is employed for this purpose. The roadway continues on a viaduct across the East Bayshore Highway and the main line tracks of the Southern Pacific and Western Pacific Railroads. This structure comes to grade in the vicinity of Spencer Street, Oakland.

A three-level structure is required at the intersection of the proposed East Bayshore Freeway and the bridge roadway to take care of all desired vehicular connections and to separate railroad traffic. A channel change is needed just south of this structure to divert the waters of Damon Slough and Leona Creeks.

Bridge traffic not desiring to use the proposed East Bayshore Freeway could proceed east on Havenscourt Boulevard to either East 14th Street or MacArthur Boulevard and then proceed either north or south.

COST ESTIMATE

Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure	21,200,000	
(3)	Superstructure	46,500,000	
(4)	Final field painting	3,200,000	
(5)	Electrical work	1,000,000	
(6)	Buildings and toll plaza	620,000	
(7)	San Francisco section	2,200,000	
(8)	Alameda section	11,200,000	
(9)	Bridge railroad track work	5,200,000	
(10)	Ballasted railroad track work	2,200,000	
(11)	Railroad tunnel	1,700,000	
(12)	Miscellaneous items of work	880,000	
	Total: Bridge construction	$96,200,000	
	Engineering	6,800,000	
	Total: Vehicular and railroad bridge		$103,000,000
(1)	San Francisco approach, complete	$1,400,000	
(2)	Alameda approach, complete	2,400,000	
(3)	Approach lighting	250,000	
(4)	Bayshore Freeway separation	1,900,000	
(5)	San Leandro Bay viaduct	3,300,000	
(6)	Damon Slough bridge	1,100,000	
(7)	Maitland Drive underpass	800,000	
(8)	Eastshore Freeway separation	1,100,000	
(9)	Miscellaneous items of work	350,000	
	Total: Approach construction	$12,600,000	
	Engineering	1,100,000	
	Total: Legislative approaches		13,700,000
(1)	Property	$4,900,000	
(2)	Legal and insurance	1,100,000	
(3)	Interest	7,300,000	
	Total: Noncontract items		13,300,000
	GRAND TOTAL		$130,000,000

The cost estimates shown are for connection to ing railroad facilities on each end of the project and do not include the many additional items that uld be necessary to fully complete the railroad lay- Some of these items which are not included but ch would be necessary in any long range program

(1) Union Railroad passenger terminal in San cisco.

(2) Round house and machine shop facilities.

(3) Passenger car servicing facilities.

(4) New and reconstructed trackage in Oakland.

(5) New and reconstructed trackage in San Fran-

(6) Additional interlocking facilities.

(7) Additional coach yards.

(8) Additional freight yards.

(9) Various signal towers, shops, and other build-

(10) Additional railroad tunnels.

To obtain an estimate of this cost would take y months of negotiations with the railroads and ld require detail plans, specifications, and operat- agreements, and was, therefore, beyond the scope this report. However, it is probable that such facil- could not be provided for less than $50,000,000.

TRERO POINT (ARMY STREET) ALAMEDA (WEBSTER STREET)

LOCATION NO. 12—SEE PLATE V-67

This crossing consists of a combined mole, trestle tube. Four traffic lanes for all types of vehicles ld be provided in each direction.

The following three locations were investigated to rmine the most favorable site.

Termini	Length of Water Crossing
(1) Army Street, San Francisco, to Main Street, Alameda	27,100 ft.
(2) Army Street, San Francisco, to Webster Street, Alameda	30,800 ft.
(3) Army Street, San Francisco, to High Street, Alameda	38,300 ft.

Although proposal (1) has the shortest water cross- the structure needed to span the Oakland Estuary the various tracks, industrial establishments, etc., ld make the total cost of the project higher than posal (2). The southernmost proposal (3), would be least desirable. The water crossing is the longest, facilities for handling traffic are the poorest, and terminus is the most distant from the traffic center of the East Bay area. Proposal (2) was selected as it corresponds most closely with the over-all plan for the East Bayshore Highway, the proposed new Estuary Tube, and with the routing of traffic across Alameda.

This project starts from the West Bayshore Freeway in San Francisco, having a distribution structure at this point for the separation of traffic. A similar structure is proposed at Third and Army Streets. Army Street is used as an approach. The mole fill starts at Maryland Street and proceeds as an eight-lane divided highway to the start of the trestle spans.

The main channel under-water crossing consists of four tubes of two lanes each. The tube sections are of reinforced concrete and each is 200 feet long. These tube sections would have an external diameter of 38 feet with three-foot walls, and 136 of these sections would be required to give a clear channel 2,500 feet wide, or a restricted channel of 3,200-foot opening.

The above-water crossing consists of a concrete viaduct 6,700 feet long and a mole 13,500 feet long. In Alameda, it is proposed to convert Webster and Sixth to one-way streets for northbound and southbound traffic respectively.

The cost of an additional Oakland Estuary Tube and Webster Street Undercrossing has been included in this estimate. This tube carries traffic in one direction and connects with Sixth Street, while traffic in the opposite direction uses the present Posey Tube. The Webster Street structure will separate all tube traffic, which is at grade, from the East Bayshore Freeway traffic. Connections can be made with this highway. It will be noted that the two tubes provide but four lanes into Oakland, whereas the main crossing of the Bay will have eight lanes. Local traffic will probably fill both of these tubes to capacity at peak hours, so other distributing structures will be needed which are not included in the estimate for this crossing.

COST ESTIMATE

Item	Description	Cost	
(1)	Borings and explorations	$400,000	
(2)	Substructure	4,200,000	
(3)	Dredger fill and rock wall	6,500,000	
(4)	Fender protection	12,400,000	
(5)	Tube	43,500,000	
(6)	Mechanical work	4,800,000	
(7)	Electrical work	3,000,000	
(8)	Buildings	10,600,000	
(9)	Transition section	7,500,000	
(10)	Bridge spans	5,400,000	
(11)	Administration building and toll plaza	600,000	
(12)	Railroad work	1,200,000	
(13)	Mole paving	780,000	
(14)	Miscellaneous items of work	1,320,000	
	Total: Tube and causeway construction	$102,200,000	
	Engineering	7,100,000	
	Total: Crossing		$109,300,000

(Cost Estimate Continued on Page 112)

(1)	San Francisco approach, complete	$1,000,000	
(2)	Alameda approach, complete	360,000	
(3)	Approach lighting	180,000	
(4)	Bayshore freeway separation	2,250,000	
(5)	Third Street separation	1,050,000	
(6)	Oakland Estuary tube	6,600,000	
(7)	Webster Street underpass	700,000	
(8)	Miscellaneous items of work	60,000	
	Total: Approach construction	$12,200,000	
	Engineering	1,100,000	
	Total: Legislative approaches		13,300,000
(1)	Property	$5,400,000	
(2)	Legal and insurance	1,300,000	
(3)	Interest	7,700,000	
	Total: Noncontract items		14,400,000
	GRAND TOTAL		$137,000,000

TELEGRAPH HILL TO KEY MOLE

COMBINATION WEST BAY LOCATION 3 AND EAST BAY LOCATION 7 STRUCTURES

This combination has been selected to show the total cost of the most favorable West Bay structure terminating on Telegraph Hill (that of Location 3) and the most favorable East Bay structure (that of Location 7), which terminates on the north side of Key Mole.

The most economical West Bay structure terminating on Telegraph Hill was shown to be the four-span suspension bridge with 2,900-foot main spans and 1,450-foot side spans, and the most economical East Bay structure was shown to be a bridge similar to the present East Bay crossing, which would be located on a parallel alignment to the north, and which would terminate on the north side of the Key Mole. For this combination a traffic interchange would be required either at the west end of the Key Mole or on Yerba Buena Island. Arrangement of lanes and possible operation of the two parallel East Bay crossings as one-way bridges would depend upon the location of this interchange.

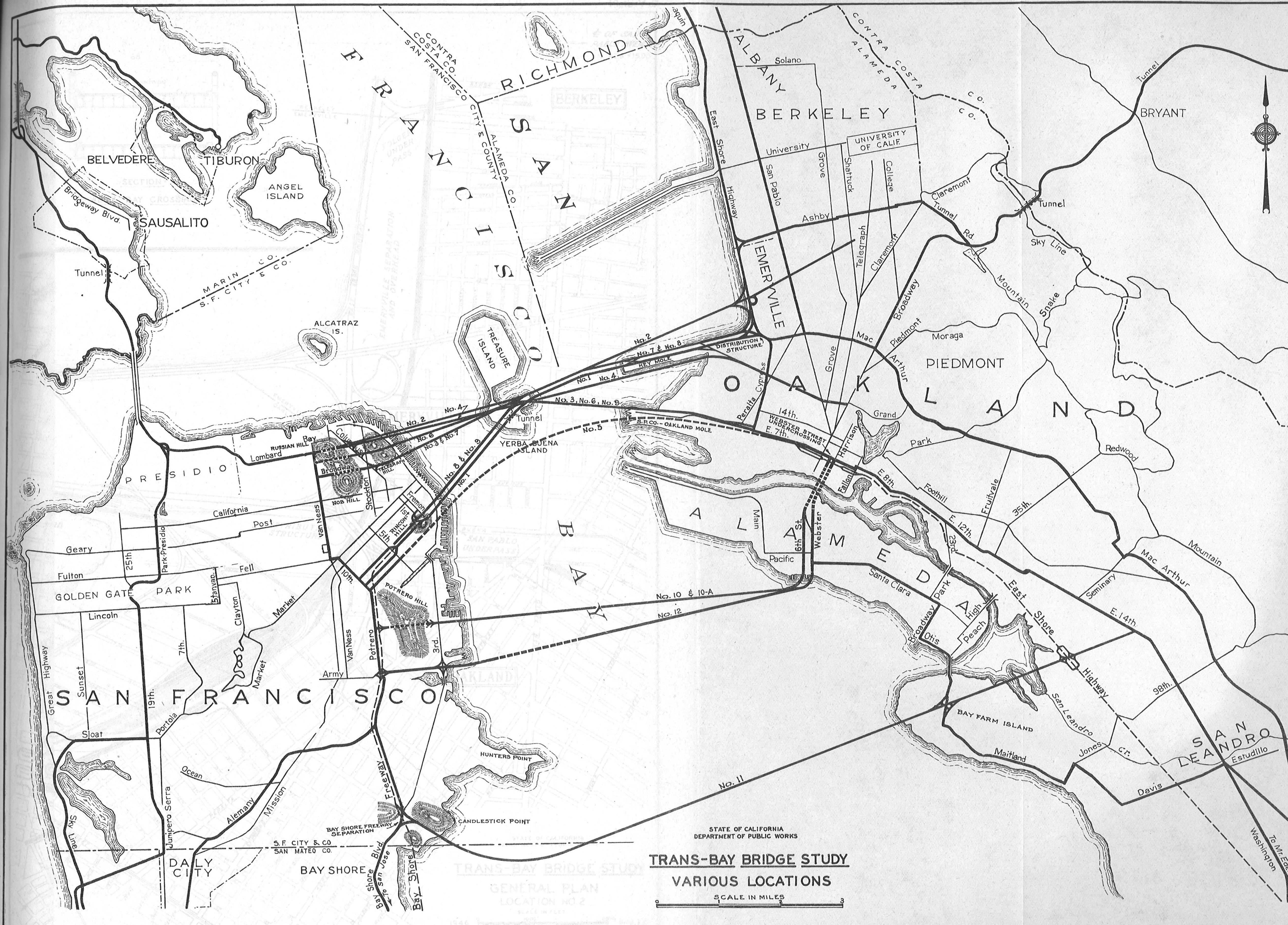
COST ESTIMATE

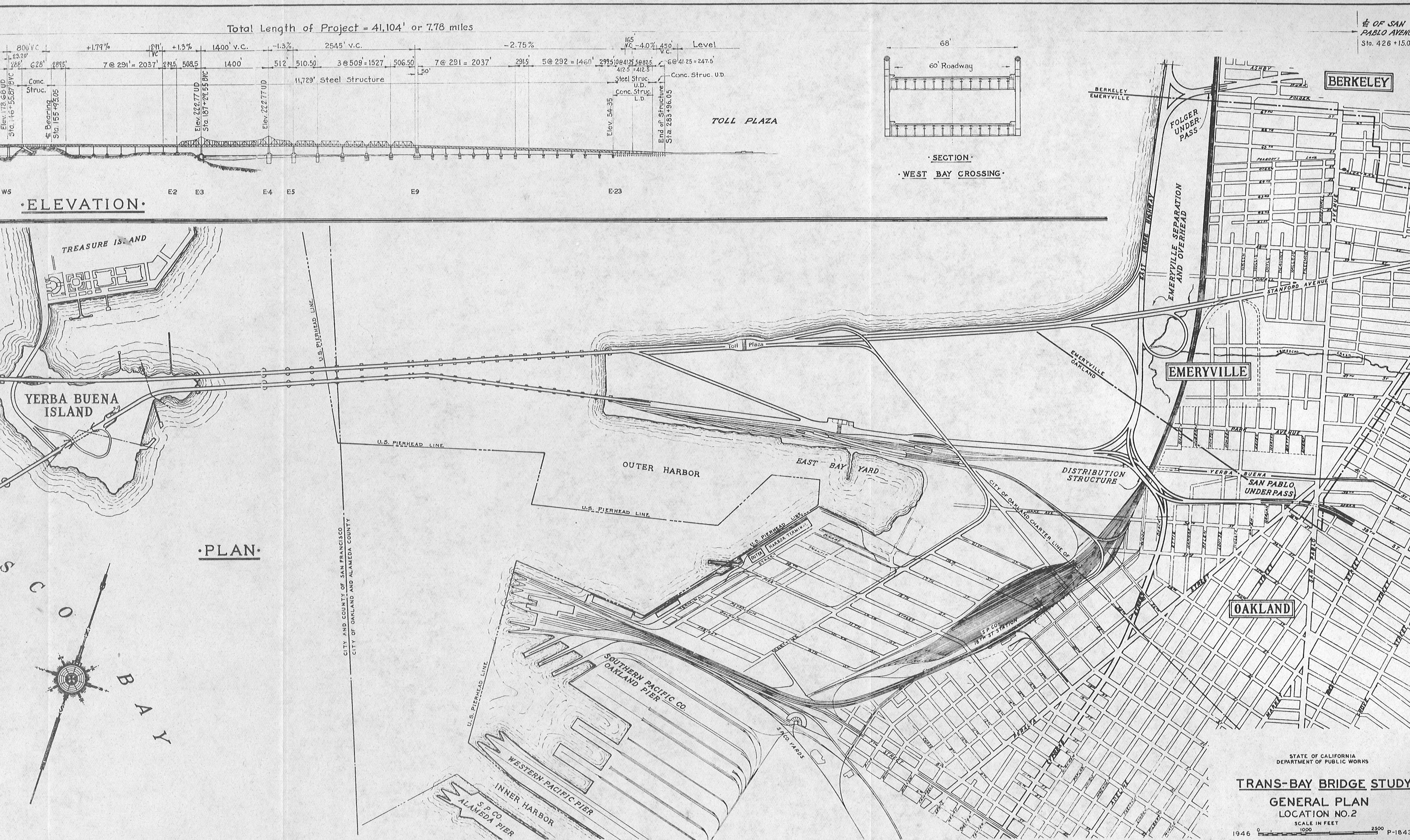
Item	*Description*	*Cost*	
(1)	Borings and exploration	$300,000	
(2)	Substructure—West Bay	10,300,000	
(3)	Substructure—East Bay	7,600,000	
(4)	Superstructure—West Bay	25,800,000	
(5)	Superstructure—East Bay	17,900,000	
(6)	Yerba Buena units	2,800,000	
(7)	Final field painting	1,600,000	
(8)	San Francisco section	710,000	
(9)	Electrical work	600,000	
(10)	Buildings and toll plaza	280,000	
(11)	Miscellaneous items of work	340,000	
	Total: Bridge construction	$68,230,000	
	Engineering	3,400,000	
	Total: Bridge		$71,6[illegible]
(1)	San Francisco approaches, complete	1,060,000	
(2)	Oakland approaches, complete	2,200,000	
(3)	Approach lighting	80,000	
(4)	22d Street underpass	1,600,000	
(5)	Cypress Street separation	640,000	
(6)	Mole overhead	750,000	
(7)	Port of Oakland overhead	120,000	
(8)	Miscellaneous items of work	60,000	
	Total: Approach construction	$6,510,000	
	Engineering	560,000	
	Total: Legislative approaches		7,0[illegible]
(1)	Property	$3,900,000	
(2)	Legal and insurance	800,000	
(3)	Interest	4,800,000	
	Total: Noncontract items		9,5[illegible]
	GRAND TOTAL		$88,2[illegible]

r at the west end of the Key Mole or on Yerba Island. Arrangement of lanes and possible ope of the two parallel East Bay crossings as one-way es would depend upon the location of this inter ge.

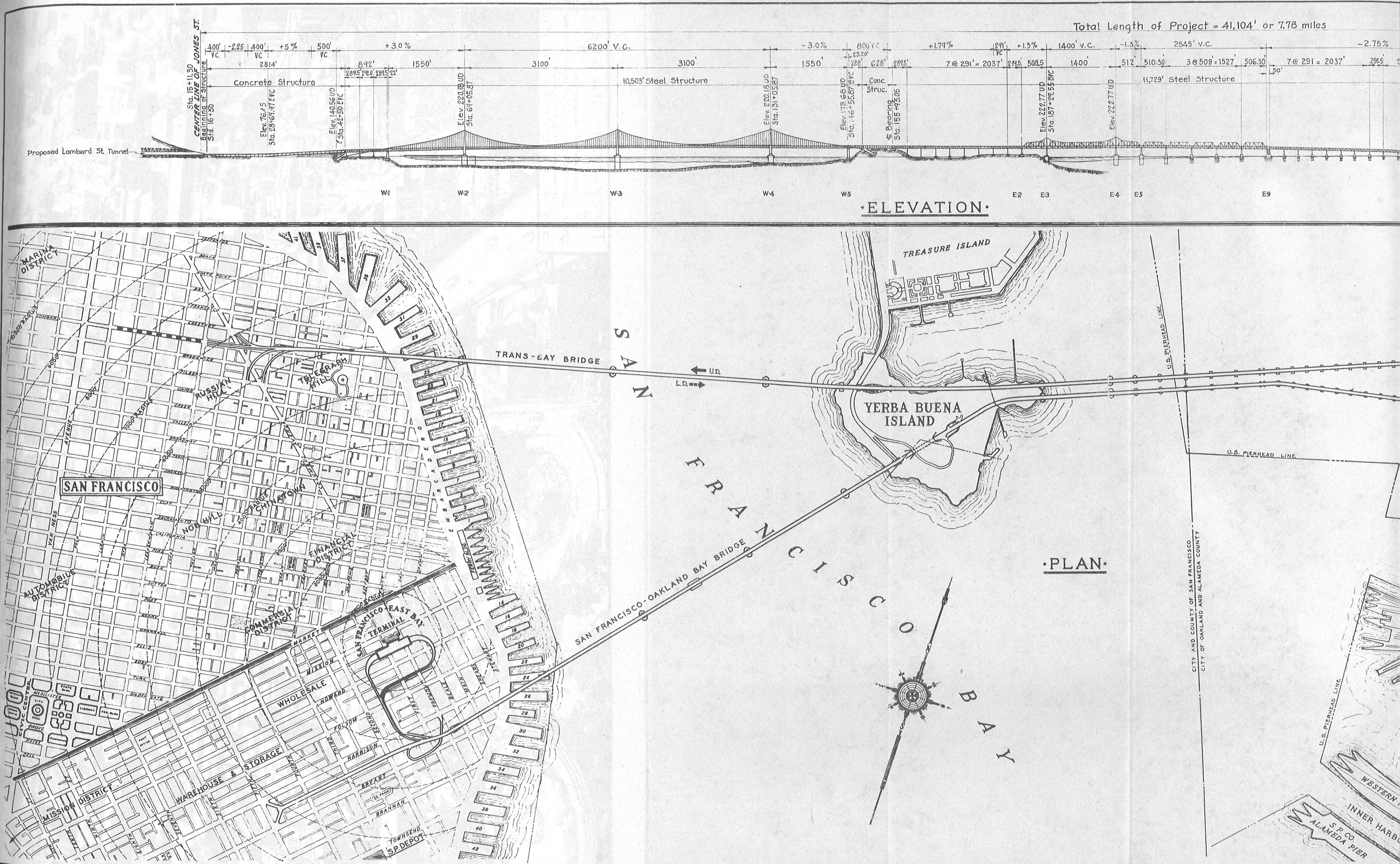
T ESTIMATE

Description	Cost	
Borings and exploration	$300,000	
Substructure—West Bay	10,300,000	
Substructure—East Bay	7,600,000	
Superstructure—West Bay	25,800,000	
Superstructure—East Bay	17,900,000	
Yerba Buena units	2,800,000	
Final field painting	1,600,000	
San Francisco section	710,000	
Electrical work	600,000	
Buildings and toll plaza	280,000	
Miscellaneous items of work	340,000	
Total: Bridge construction	$68,230,000	
Engineering	3,400,000	
Total: Bridge		$71,630,000
San Francisco approaches, complete	1,060,000	
Oakland approaches, complete	2,200,000	
Approach lighting	80,000	
2d Street underpass	1,600,000	
Cypress Street separation	640,000	
Mole overhead	750,000	
Port of Oakland overhead	120,000	
Miscellaneous items of work	60,000	
Total: Approach construction	$6,510,000	
Engineering	560,000	
Total: Legislative approaches		7,070,000
Property	$3,900,000	
Legal and insurance	800,000	
Interest	4,800,000	
Total: Noncontract items		9,500,000
GRAND TOTAL		$88,200,000





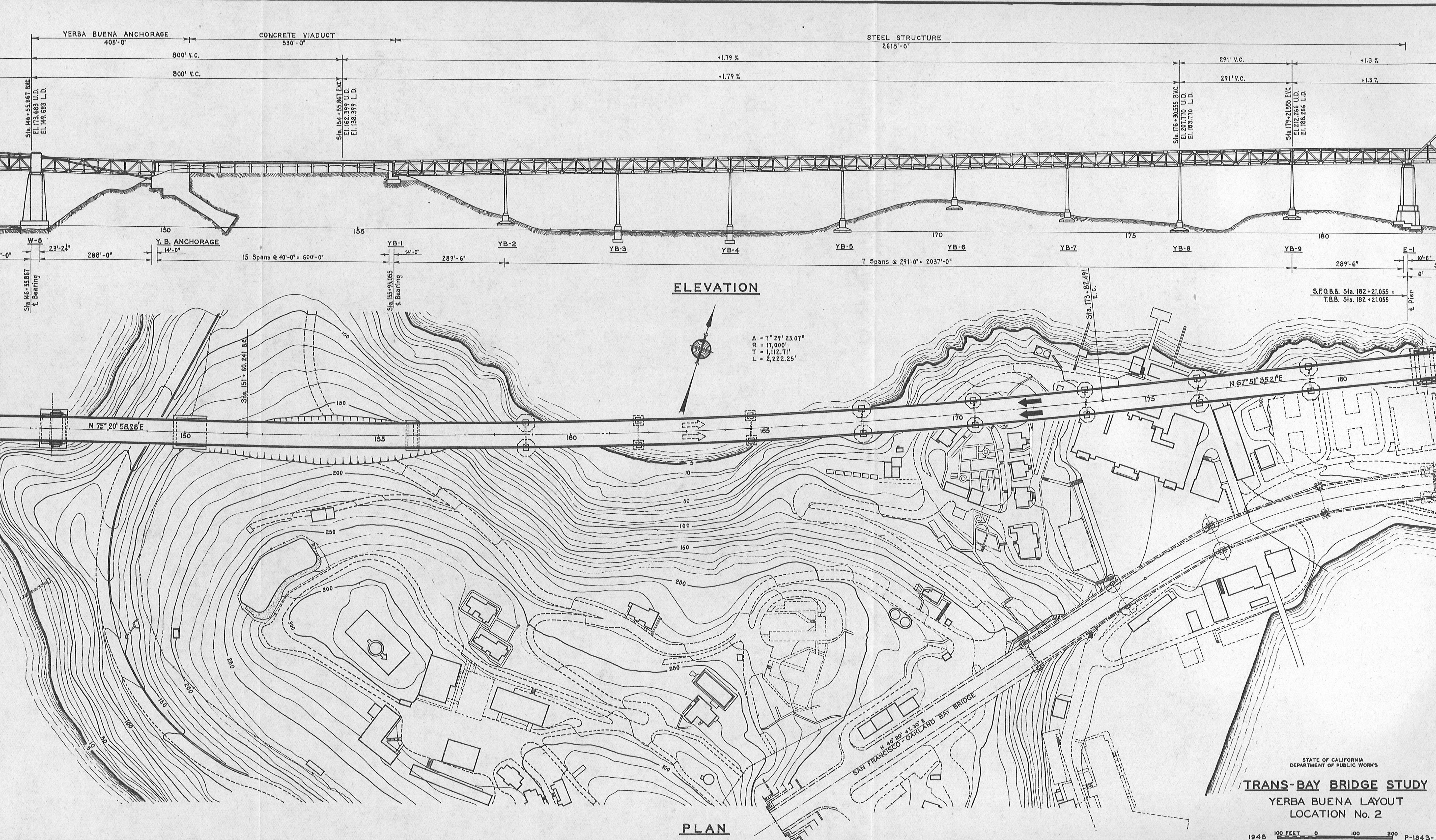
Total Length of Project = 41,104' or 7.78 miles
11,729' Steel Structure
TOLL PLAZA
·ELEVATION·
·SECTION·
·WEST BAY CROSSING·
68'
60' Roadway
℄ OF SAN PABLO AVENUE
Sta. 426 + 15.00
·PLAN·
TREASURE ISLAND
YERBA BUENA ISLAND
BAY
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
OUTER HARBOR
EAST BAY YARD
Toll Plaza
BERKELEY
EMERYVILLE
OAKLAND
BERKELEY EMERYVILLE
EMERYVILLE OAKLAND
FOLGER UNDER-PASS
EMERYVILLE SEPARATION AND OVERHEAD
EAST SHORE HIGHWAY
STANFORD AVENUE
PARK AVENUE
YERBA BUENA
DISTRIBUTION STRUCTURE
SAN PABLO UNDERPASS
CITY OF OAKLAND CHARTER LINE OF
S.P. CO. 16TH ST STATION
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
S.P. CO. YARDS
OUTER HARBOR TERMINAL
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 2
SCALE IN FEET
1946
P-1843-



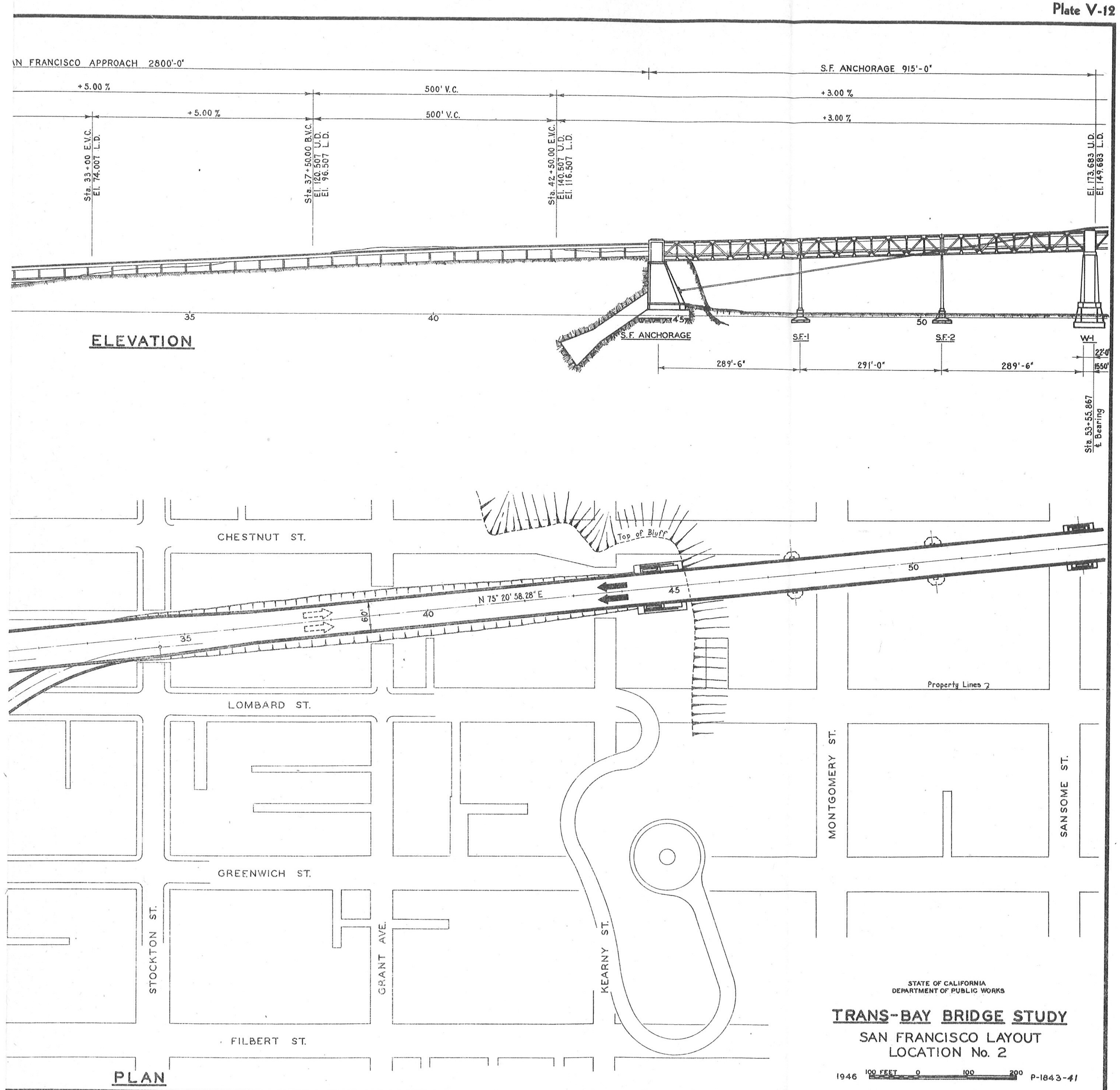
Total Length of Project = 41,104' or 7.78 miles
Concrete Structure
10,503' Steel Structure
11,729' Steel Structure
Proposed Lombard St. Tunnel
CENTER LINE OF JONES ST.
Beginning of Structure
W-1
W-2
W-3
W-4
W-5
E2
E3
E4
E5
E9
·ELEVATION·
TREASURE ISLAND
TRANS-BAY BRIDGE
U.D.
L.D.
YERBA BUENA ISLAND
SAN FRANCISCO BAY
·PLAN·
SAN FRANCISCO
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN FRANCISCO-EAST BAY TERMINAL
MARINA DISTRICT
RUSSIAN HILL
TELEGRAPH HILL
NOB HILL
CHINATOWN
FINANCIAL DISTRICT
AUTOMOBILE DISTRICT
COMMERCIAL DISTRICT
WHOLESALE
WAREHOUSE & STORAGE
MISSION DISTRICT
CIVIC CENTER
S.P. DEPOT
EMBARCADERO
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
WESTERN
INNER HARBO
S.P. CO. ALAMEDA PIER

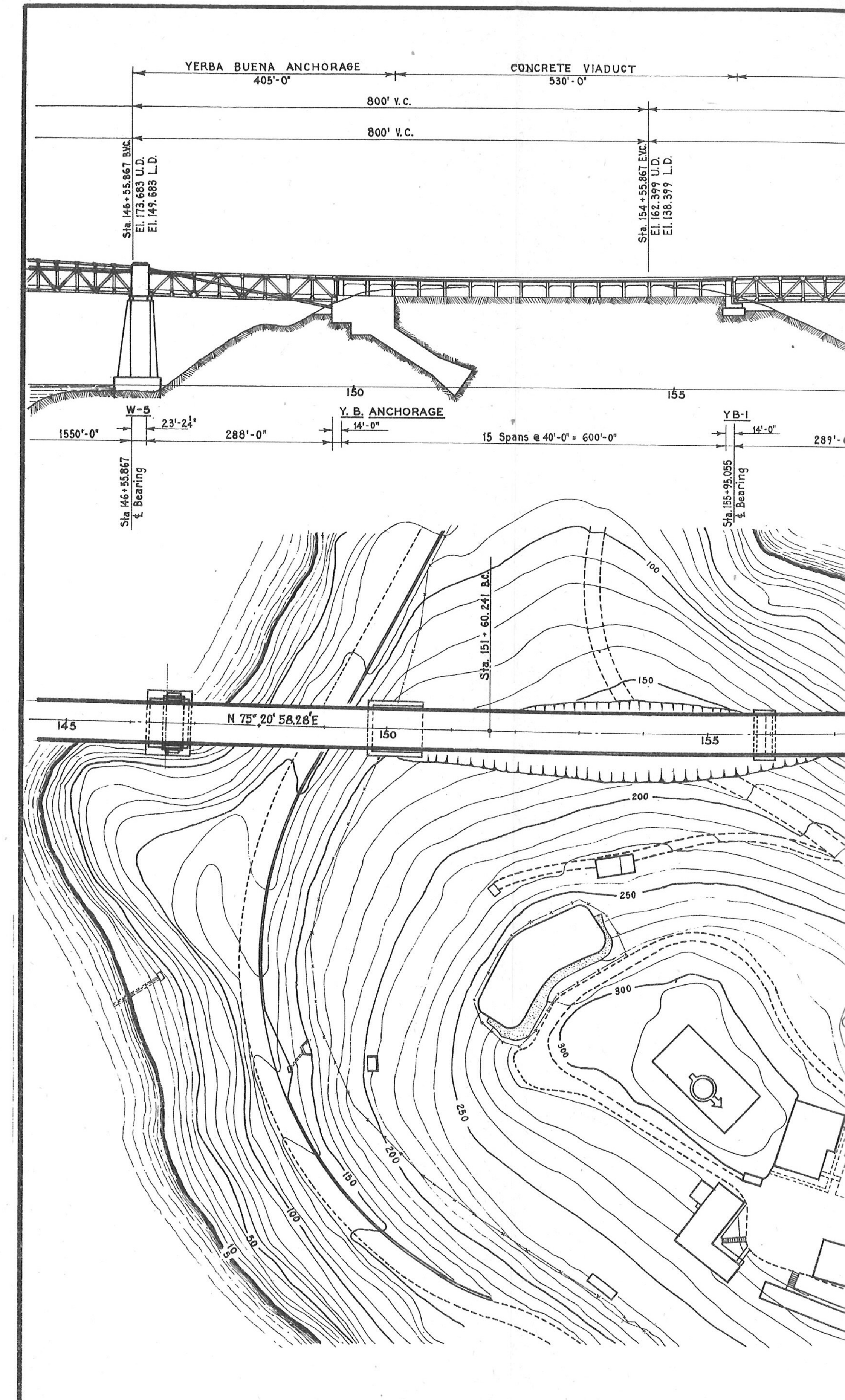
Plate V-10

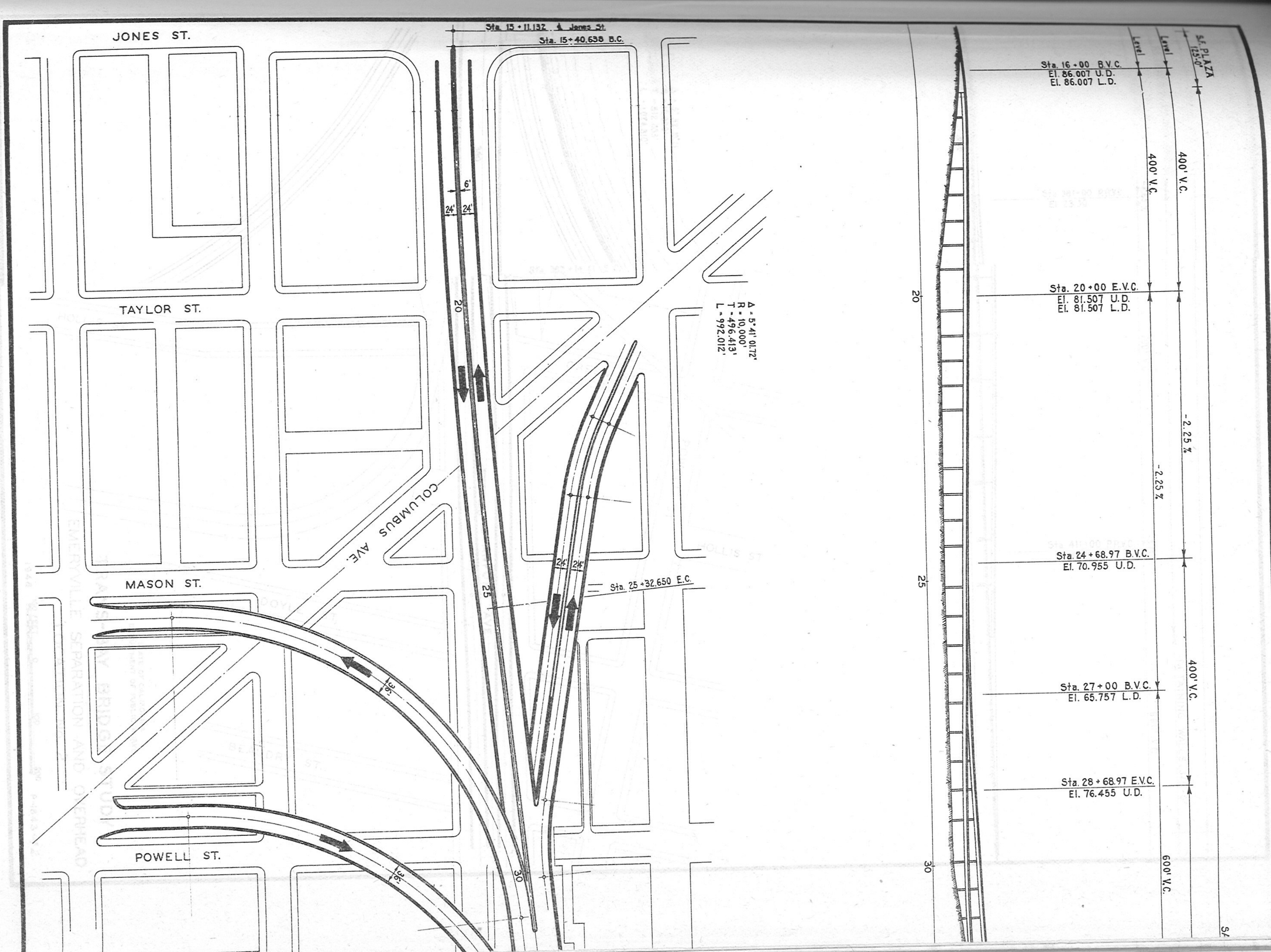
Plate V-11

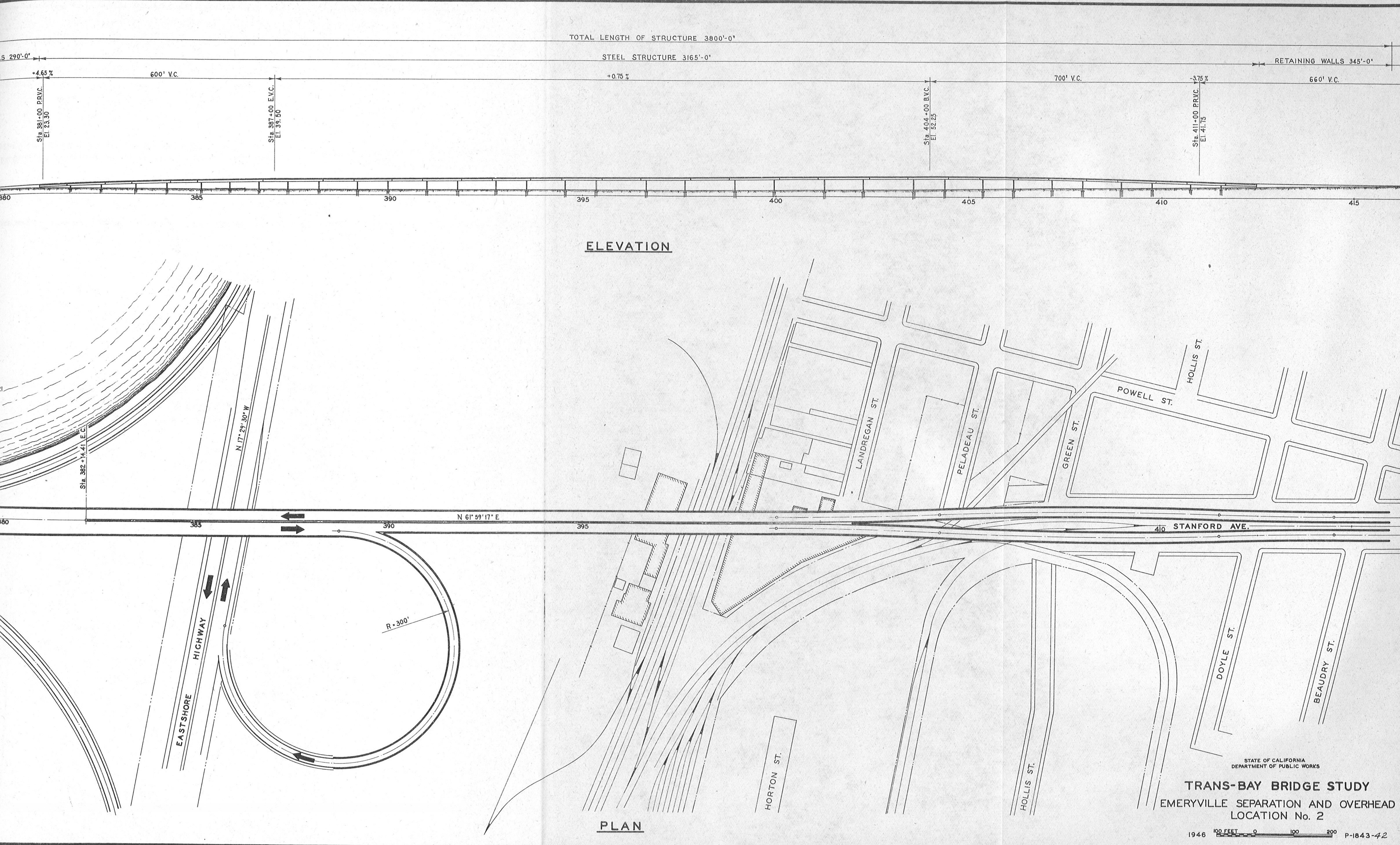


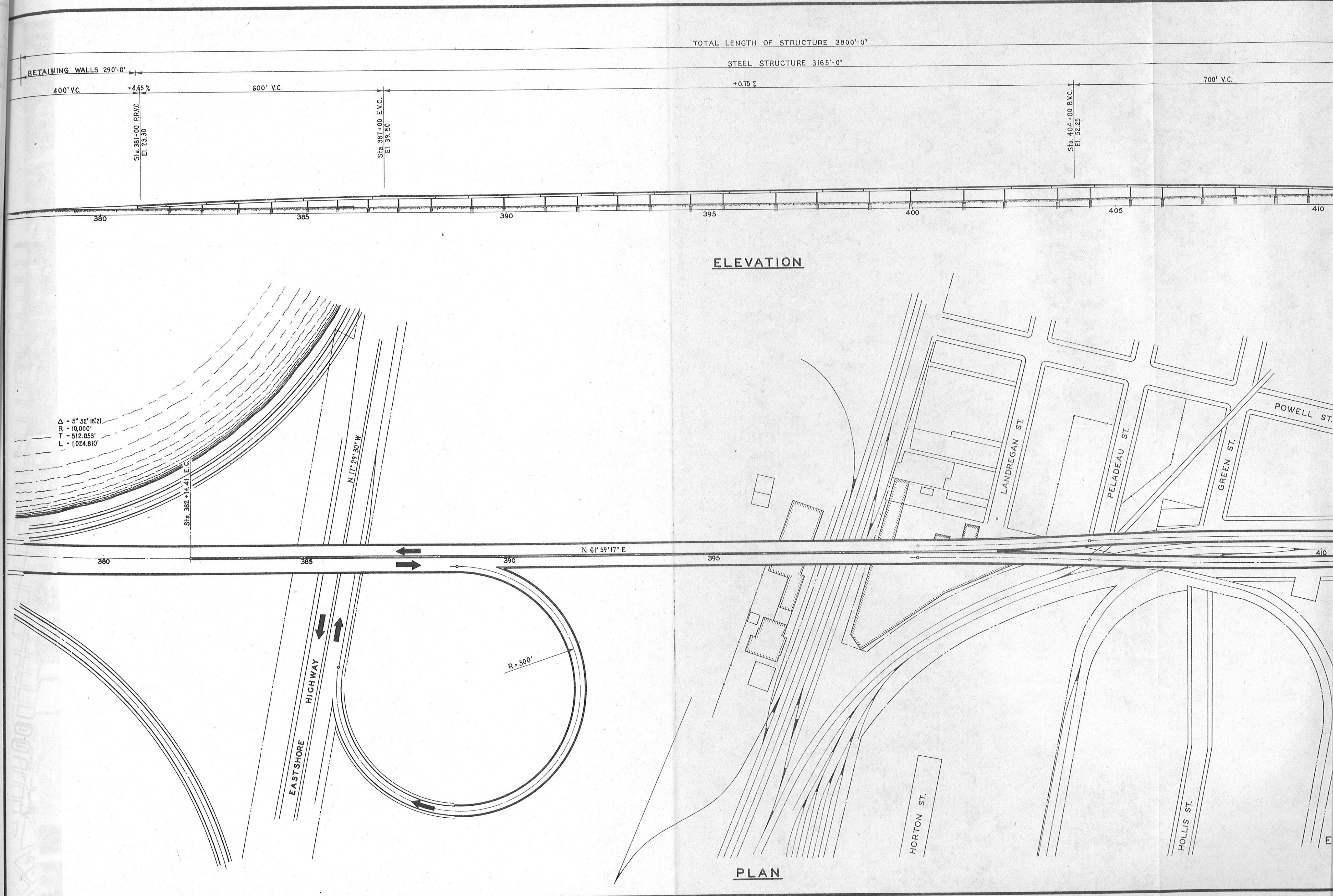
YERBA BUENA ANCHORAGE
405'-0"
CONCRETE VIADUCT
530'-0"
STEEL STRUCTURE
2618'-0"
800' V.C.
+1.79 %
291' V.C.
+1.3 %
Sta. 146+55.867 BVC
El. 173.683 U.D.
El. 149.683 L.D.
Sta. 154+55.867 EVC
El. 162.399 U.D.
El. 138.399 L.D.
Sta. 176+30.555 BVC
El. 207.770 U.D.
El. 183.770 L.D.
Sta. 179+21.555 EVC
El. 212.266 U.D.
El. 188.266 L.D.
W-5
Y. B. ANCHORAGE
YB-1
YB-2
YB-3
YB-4
YB-5
YB-6
YB-7
YB-8
YB-9
E-1
288'-0"
15 Spans @ 40'-0" = 600'-0"
289'-6"
7 Spans @ 291'-0" = 2037'-0"
Sta. 146+55.867 ℄ Bearing
Sta. 155+95.055 ℄ Bearing
Sta. 173+82.491 E.C.
S.F.O.B.B. Sta. 182+21.055 =
T.B.B. Sta. 182+21.055
℄ Pier
ELEVATION
Δ = 7° 29' 23.07"
R = 17,000'
T = 1,112.71'
L = 2,222.25'
Sta. 151+60.241 B.C.
N 75° 20' 58.28" E
N 67° 51' 35.21" E
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 2
1946
100 FEET 0 100 200
P-1843-38

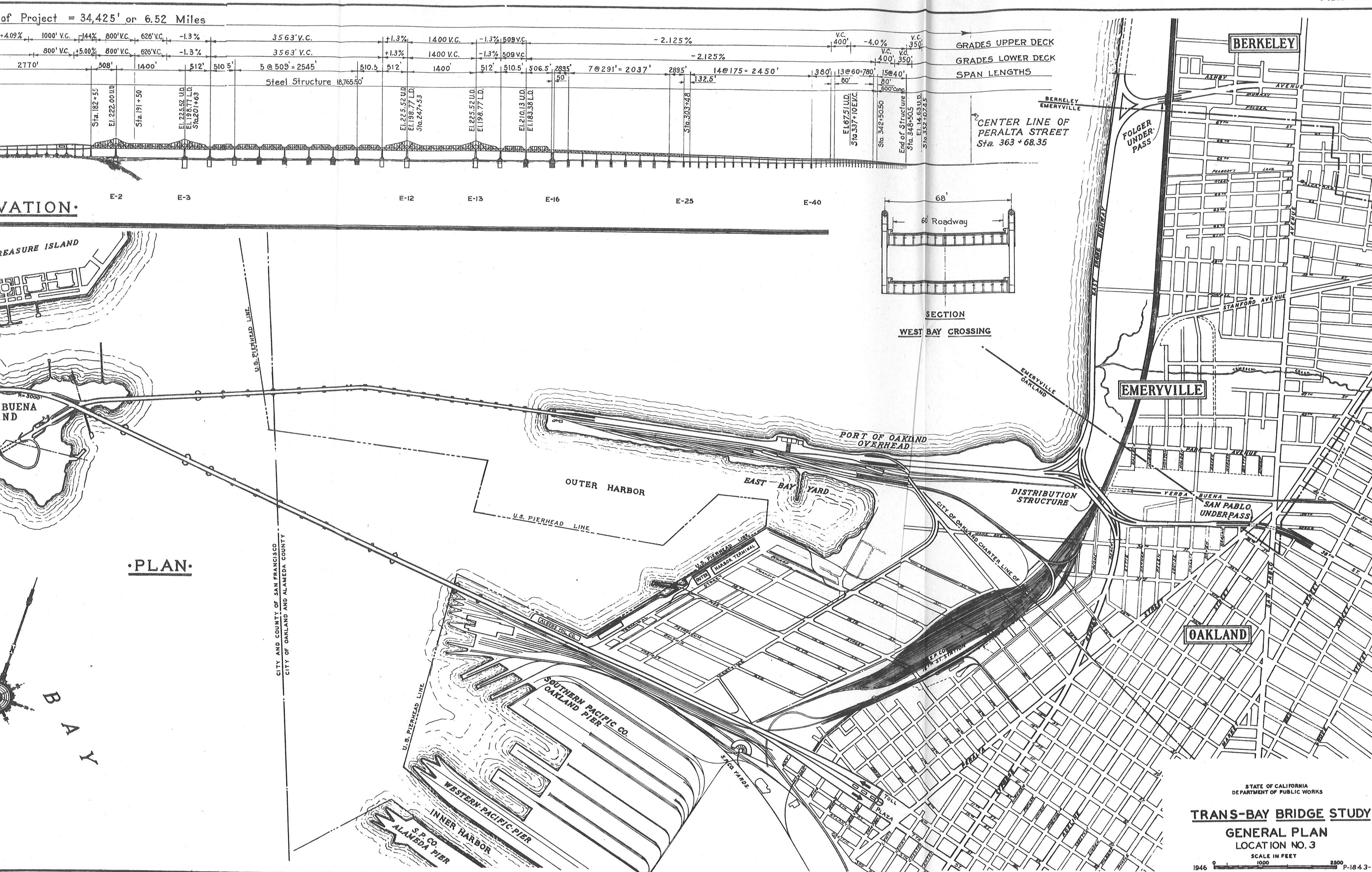

AN FRANCISCO APPROACH 2800'-0"
S.F. ANCHORAGE 915'-0"
+5.00 %
500' V.C.
+3.00 %
Sta. 33+00 E.V.C.
El. 74.007 L.D.
Sta. 37+50.00 B.V.C.
El. 120.507 U.D.
El. 96.507 L.D.
Sta. 42+50.00 E.V.C.
El. 140.507 U.D.
El. 116.507 L.D.
El. 173.683 U.D.
El. 149.683 L.D.
ELEVATION
S.F. ANCHORAGE
S.F-1
S.F-2
W-1
289'-6"
291'-0"
22'-0"
Sta. 53+55.867
℄ Bearing
CHESTNUT ST.
Top of Bluff
N 75° 20' 58.28" E
LOMBARD ST.
Property Lines
GREENWICH ST.
MONTGOMERY ST.
SANSOME ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
FILBERT ST.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION No. 2
1946
100 FEET 0 100 200
P-1843-41

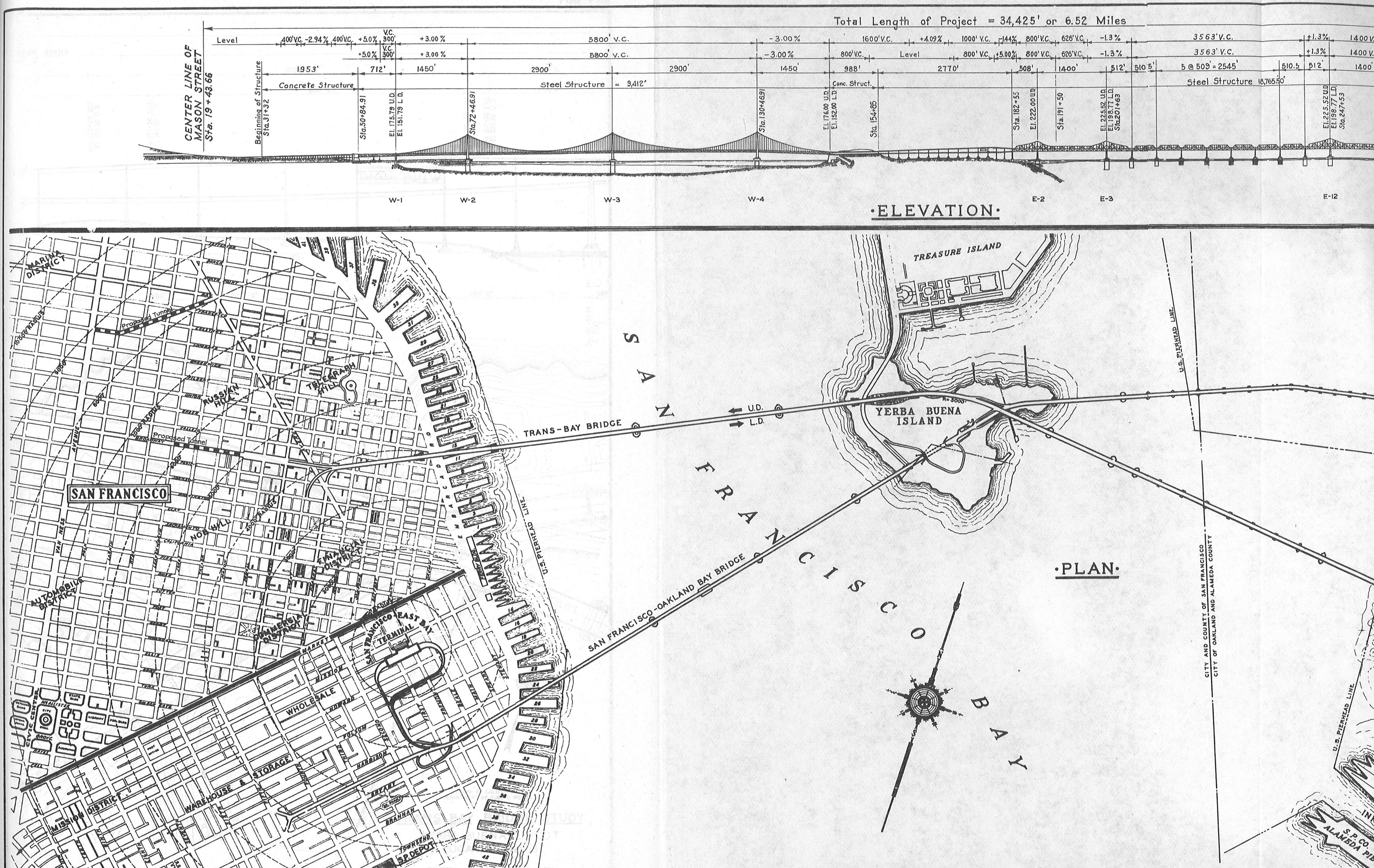

YERBA BUENA ANCHORAGE
405'-0"
CONCRETE VIADUCT
530'-0"
800' V.C.
Sta. 146+55.867 B.V.C.
El. 173.683 U.D.
El. 149.683 L.D.
Sta. 154+55.867 E.V.C.
El. 162.399 U.D.
El. 138.399 L.D.
W-5
Y. B. ANCHORAGE
YB-1
1550'-0"
23'-2¼"
288'-0"
14'-0"
15 Spans @ 40'-0" = 600'-0"
Sta. 146+55.867
℄ Bearing
Sta. 155+95.055
℄ Bearing
Sta. 151+60.241 B.C.
N 75° 20' 58.28" E

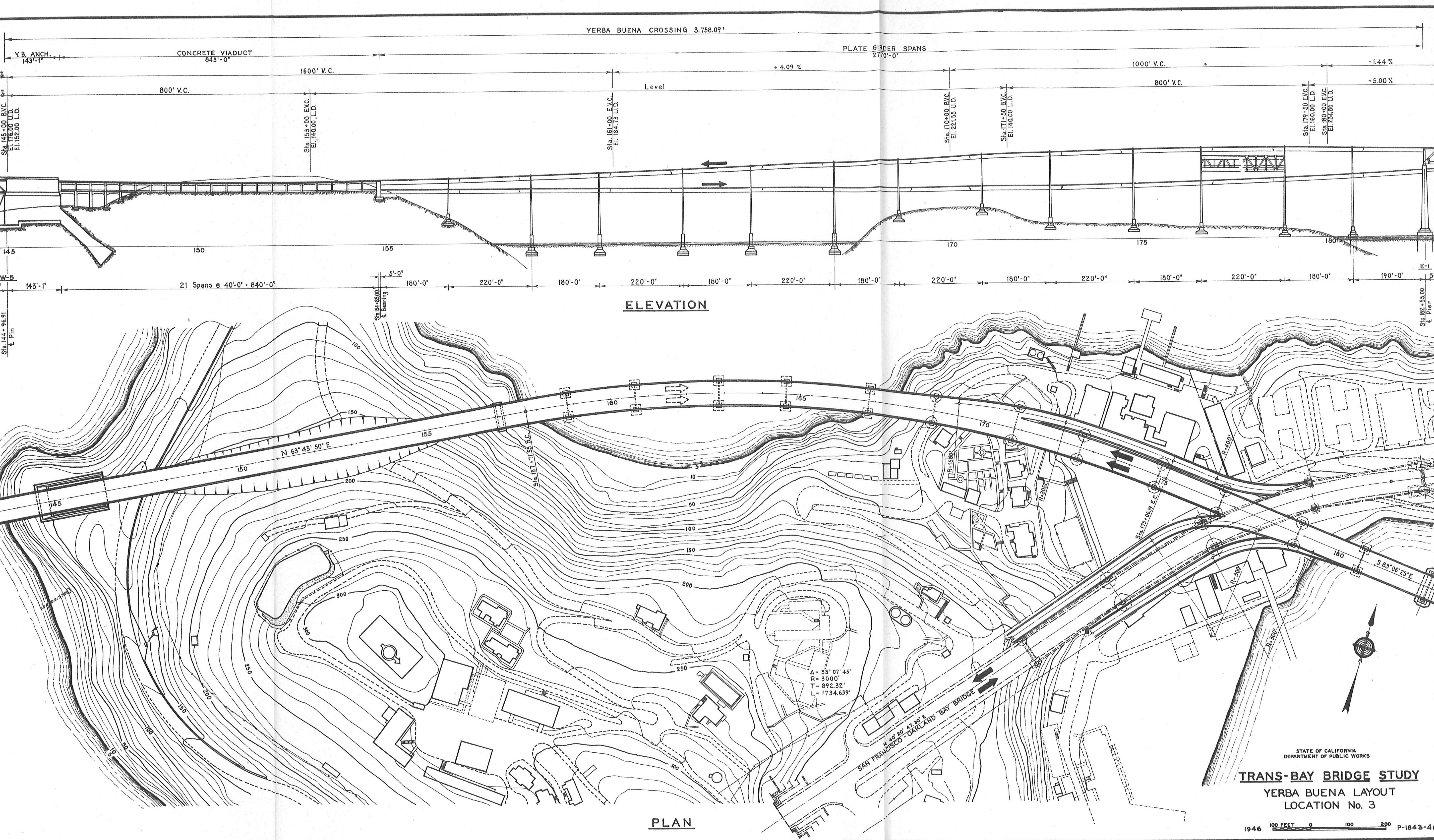

JONES ST.
TAYLOR ST.
MASON ST.
POWELL ST.
COLUMBUS AVE.
Sta. 15 + 11.132 ℄ Jones St.
Sta. 15 + 40.638 B.C.
6'
24' 24'
Δ = 5°41' 01.72"
R = 10,000'
T = 496.413'
L = 992.012'
24' 24'
Sta. 25 + 32.650 E.C.
20
25
30
S.F. PLAZA
125'-0"
Level
Level
Sta. 16 + 00 B.V.C.
El. 86.007 U.D.
El. 86.007 L.D.
400' V.C.
400' V.C.
Sta. 20 + 00 E.V.C.
El. 81.507 U.D.
El. 81.507 L.D.
-2.25 %
-2.25 %
Sta. 24 + 68.97 B.V.C.
El. 70.955 U.D.
400' V.C.
Sta. 27 + 00 B.V.C.
El. 65.757 L.D.
Sta. 28 + 68.97 E.V.C.
El. 76.455 U.D.
600' V.C.

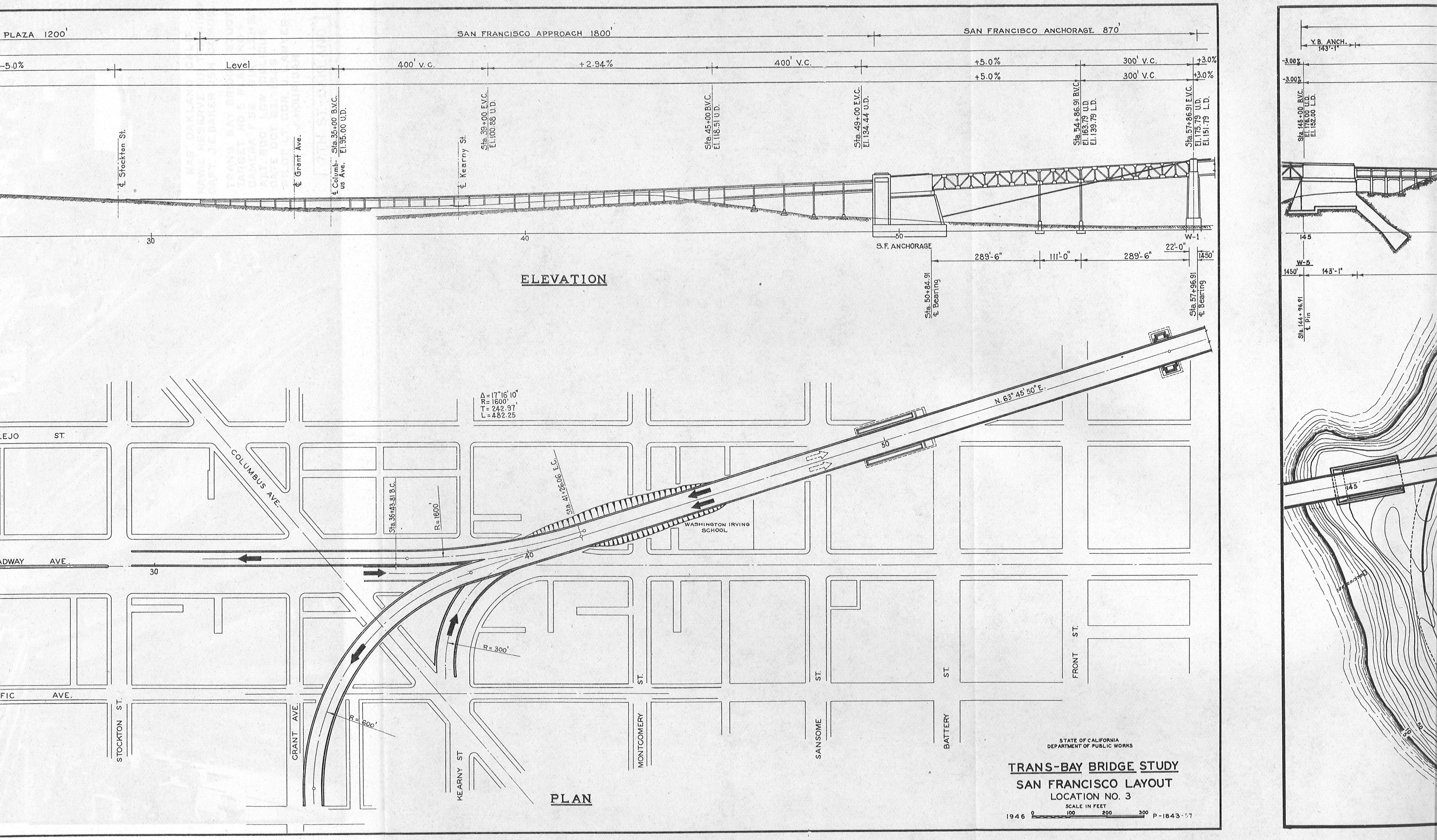

TOTAL LENGTH OF STRUCTURE 3800'-0"
STEEL STRUCTURE 3165'-0"
RETAINING WALLS 345'-0"
S 290'-0"
+4.65 %
600' V.C.
+0.75 %
700' V.C.
-3.75 %
660' V.C.
Sta. 381+00 P.R.V.C. El. 23.30
Sta. 387+00 E.V.C. El. 39.50
Sta. 404+00 B.V.C. El. 52.25
Sta. 411+00 P.R.V.C. El. 41.75
380
385
390
395
400
405
410
415
ELEVATION
Sta. 382+14.41 E.C.
N 17° 29' 30" W
N 61° 59' 17" E
R = 300'
EASTSHORE HIGHWAY
LANDREGAN ST.
PELADEAU ST.
GREEN ST.
HOLLIS ST.
POWELL ST.
STANFORD AVE.
HORTON ST.
DOYLE ST.
BEAUDRY ST.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
EMERYVILLE SEPARATION AND OVERHEAD
LOCATION No. 2
1946
100 FEET 0 100 200
P-1843-42

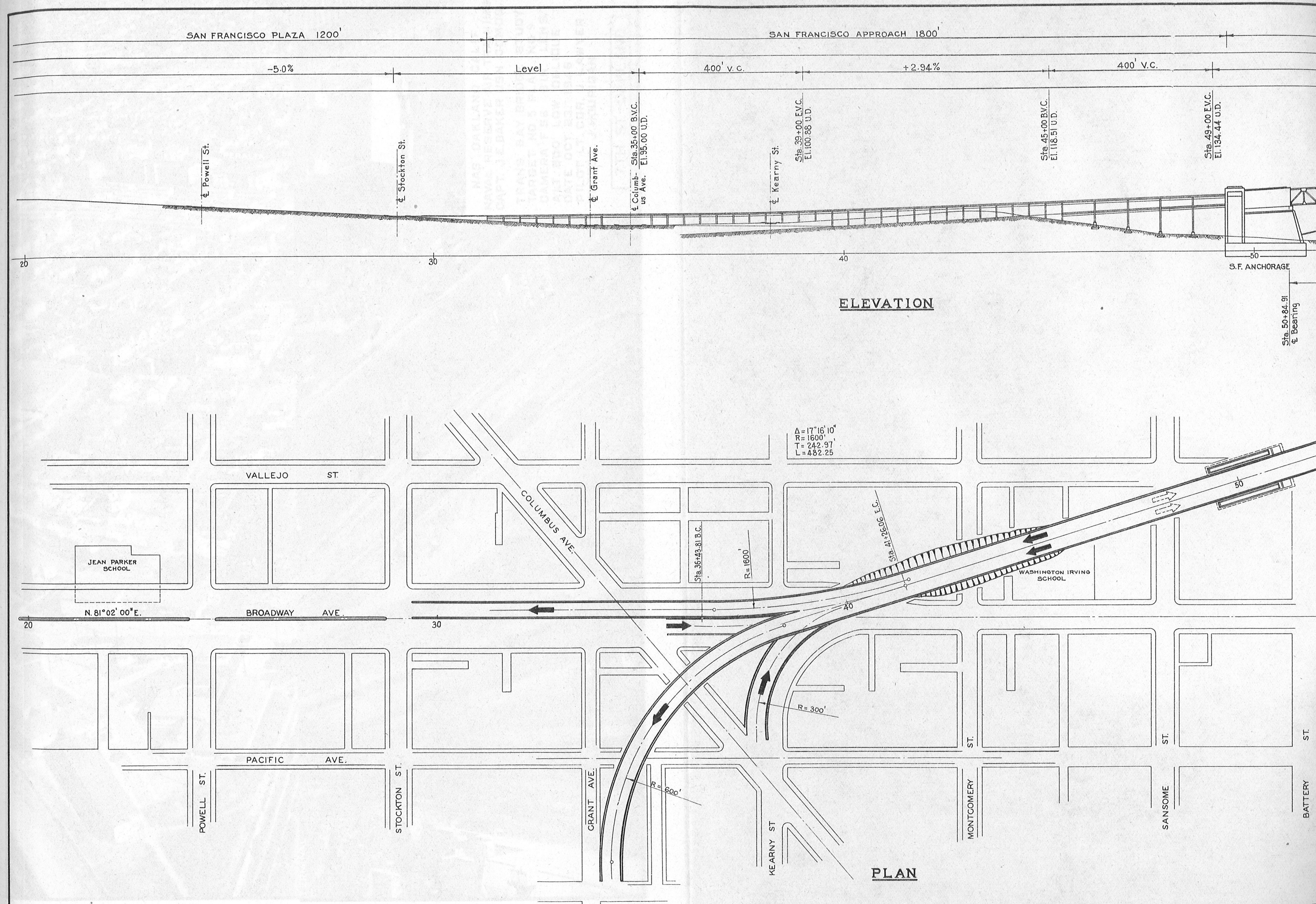

TOTAL LENGTH OF STRUCTURE 3800'-0"
STEEL STRUCTURE 3165'-0"
RETAINING WALLS 290'-0"
400' V.C.
+4.65 %
600' V.C.
+0.75 %
700' V.C.
Sta. 381+00 P.R.V.C.
El 23.30
Sta. 387+00 E.V.C.
El 39.50
Sta. 404+00 B.V.C.
El 52.25
380
385
390
395
400
405
410
ELEVATION
Δ = 5° 52' 18.21
R = 10,000'
T = 512.853'
L = 1,024.810'
Sta. 382+14.41 E.C.
N 17° 29' 30" W
N 61° 59' 17" E
R = 300'
EASTSHORE HIGHWAY
LANDREGAN ST.
PELADEAU ST.
GREEN ST.
POWELL ST.
HORTON ST.
HOLLIS ST.
PLAN

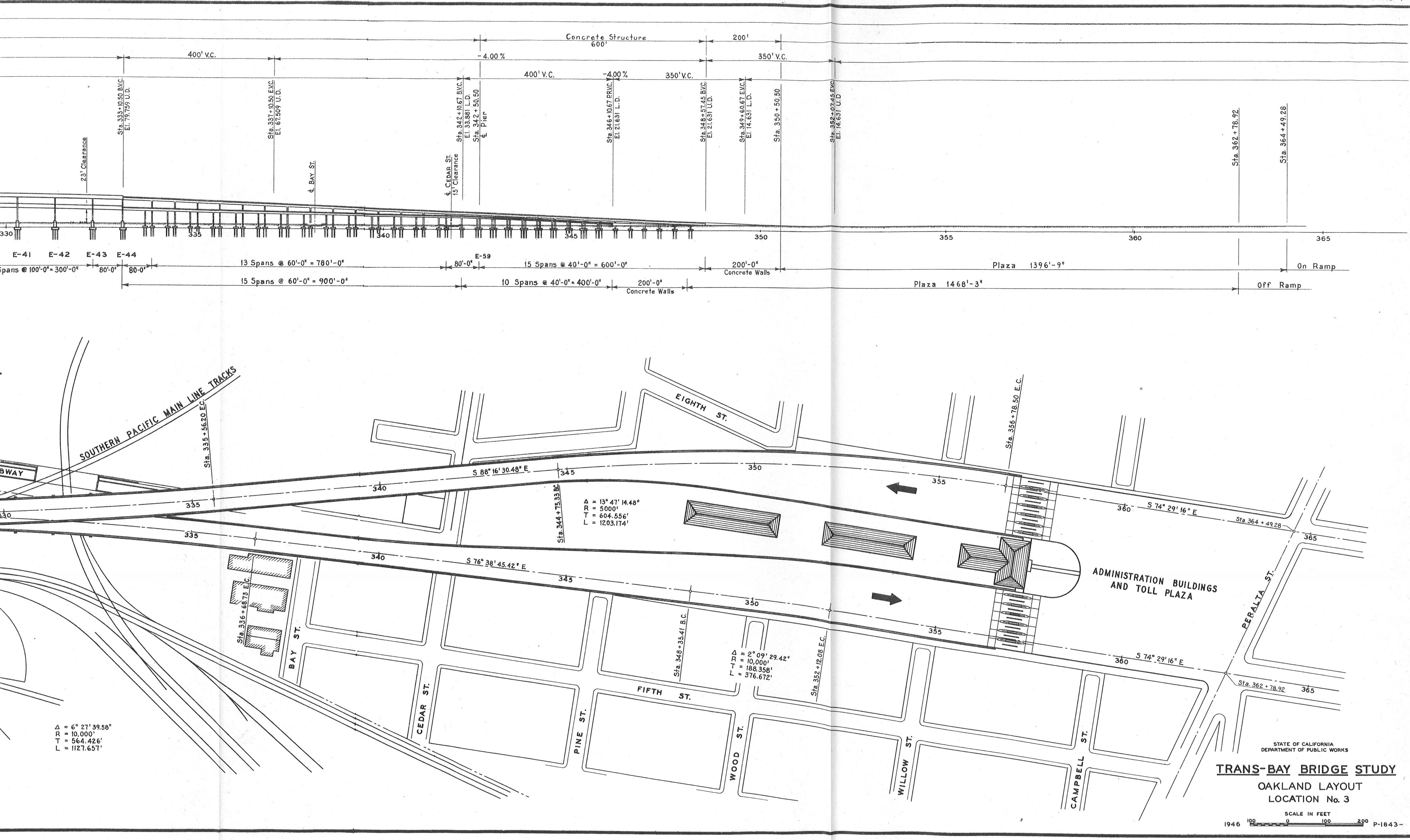

of Project = 34,425' or 6.52 Miles
GRADES UPPER DECK
GRADES LOWER DECK
SPAN LENGTHS
3563' V.C.
- 2.125%
Steel Structure
7@291' = 2037'
14@175 = 2450'
13@60=780'
CENTER LINE OF
PERALTA STREET
Sta. 363 + 68.35
VATION·
E-2
E-3
E-12
E-13
E-16
E-25
E-40
68'
60' Roadway
SECTION
WEST BAY CROSSING
TREASURE ISLAND
BUENA
ND
·PLAN·
BAY
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
OUTER HARBOR
EAST BAY YARD
PORT OF OAKLAND
OVERHEAD
DISTRIBUTION
STRUCTURE
CITY OF OAKLAND CHARTER LINE OF
OUTER HARBOR TERMINAL
SOUTHERN PACIFIC CO.
OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO.
ALAMEDA PIER
S.P. CO. YARDS
S.P. CO. 16TH ST. STATION
TOLL PLAZA
BERKELEY
BERKELEY
EMERYVILLE
ASHBY AVENUE
FOLGER UNDERPASS
EAST SHORE HIGHWAY
STANFORD AVENUE
EMERYVILLE
OAKLAND
PARK AVENUE
YERBA BUENA
SAN PABLO
UNDERPASS
OAKLAND
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 3
SCALE IN FEET
0
1000
2500
1946
P-1843-

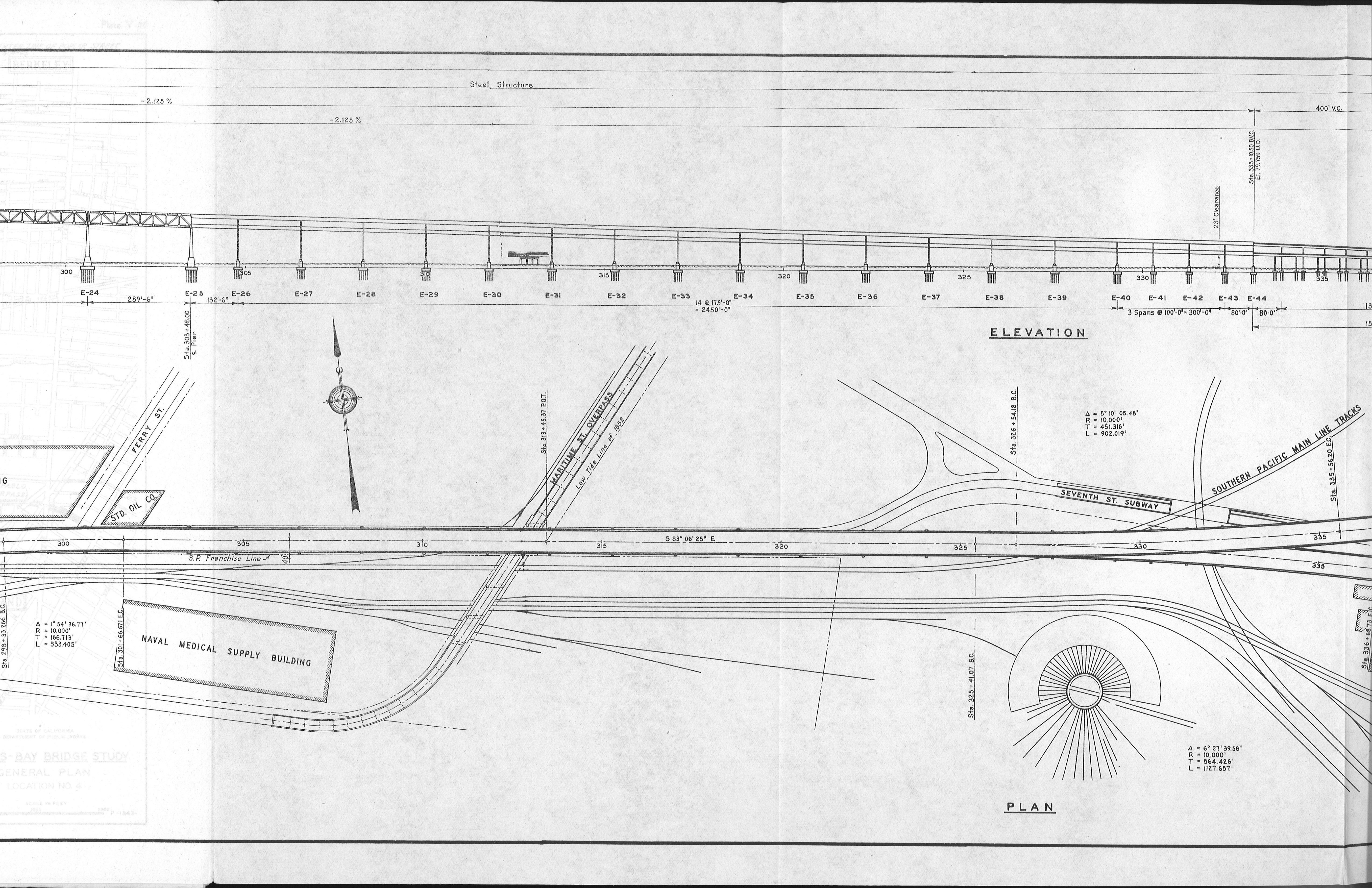

Total Length of Project = 34,425' or 6.52 Miles
CENTER LINE OF MASON STREET Sta. 19 + 43.66
Beginning of Structure Sta. 31+32
Concrete Structure
Steel Structure = 9,412'
Conc. Struct.
Steel Structure 18,765.50'
1953'
712'
1450'
2900'
2900'
1450'
988'
2770'
508'
1400'
512'
510.5'
5 @ 509' = 2545'
510.5
512'
1400'
Level
5800' V.C.
3563' V.C.
1600' V.C.
W-1
W-2
W-3
W-4
E-2
E-3
E-12
·ELEVATION·
·PLAN·
TREASURE ISLAND
YERBA BUENA ISLAND
TRANS-BAY BRIDGE
U.D.
L.D.
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN FRANCISCO BAY
SAN FRANCISCO
MARINA DISTRICT
RUSSIAN HILL
TELEGRAPH HILL
NOB HILL
FINANCIAL DISTRICT
COMMERCIAL DISTRICT
AUTOMOBILE DISTRICT
CIVIC CENTER
MISSION DISTRICT
WHOLESALE
WAREHOUSE & STORAGE
SAN FRANCISCO-EAST BAY TERMINAL
Proposed Tunnel
Proposed Tunnel
EMBARCADERO
MARKET
MISSION
HOWARD
FOLSOM
HARRISON
BRYANT
BRANNAN
TOWNSEND
S.P. DEPOT
VAN NESS
U.S. PIERHEAD LINE
U.S. PIERHEAD LINE
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
S.P. CO. ALAMEDA PIER
INNER


YERBA BUENA CROSSING 3,758.09'
Y.B. ANCH. 143'-1"
CONCRETE VIADUCT 845'-0"
PLATE GIRDER SPANS 2770'-0"
1600' V.C.
+4.09 %
1000' V.C.
-1.44 %
800' V.C.
Level
800' V.C.
+5.00 %
Sta. 145+00 B.V.C. El. 176.00 U.D. El. 152.00 L.D.
Sta. 153+00 E.V.C. El. 140.00 L.D.
Sta. 161+00 E.V.C. El. 184.73 U.D.
Sta. 170+00 B.V.C. El. 221.55 U.D.
Sta. 171+50 B.V.C. El. 140.00 L.D.
Sta. 179+50 E.V.C.
Sta. 180+00 E.V.C. El. 160.00 U.D. El. 234.80 L.D.
145
150
155
170
175
180
W-5
143'-1"
21 Spans @ 40'-0" = 840'-0"
5'-0"
180'-0"
220'-0"
180'-0"
220'-0"
180'-0"
220'-0"
180'-0"
220'-0"
180'-0"
220'-0"
180'-0"
220'-0"
180'-0"
190'-0"
E-1
508'
Sta. 154+86.00 ℄ Bearing
Sta. 144+96.91 ℄ Pin
Sta. 182+55.00 ℄ Pier
ELEVATION
N 63°45' 50" E
Sta. 157+71.55 B.C.
Sta. 175+06.19 E.C.
S 83°06' 25" E
R=1500'
R=3052'
R=400'
R=300'
R=300'
Δ = 33° 07' 45"
R = 3000'
T = 892.32'
L = 1734.639'
N 40° 20' 47.30" E
SAN FRANCISCO OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 3
1946
100 FEET 0 100 200
P-1843-46

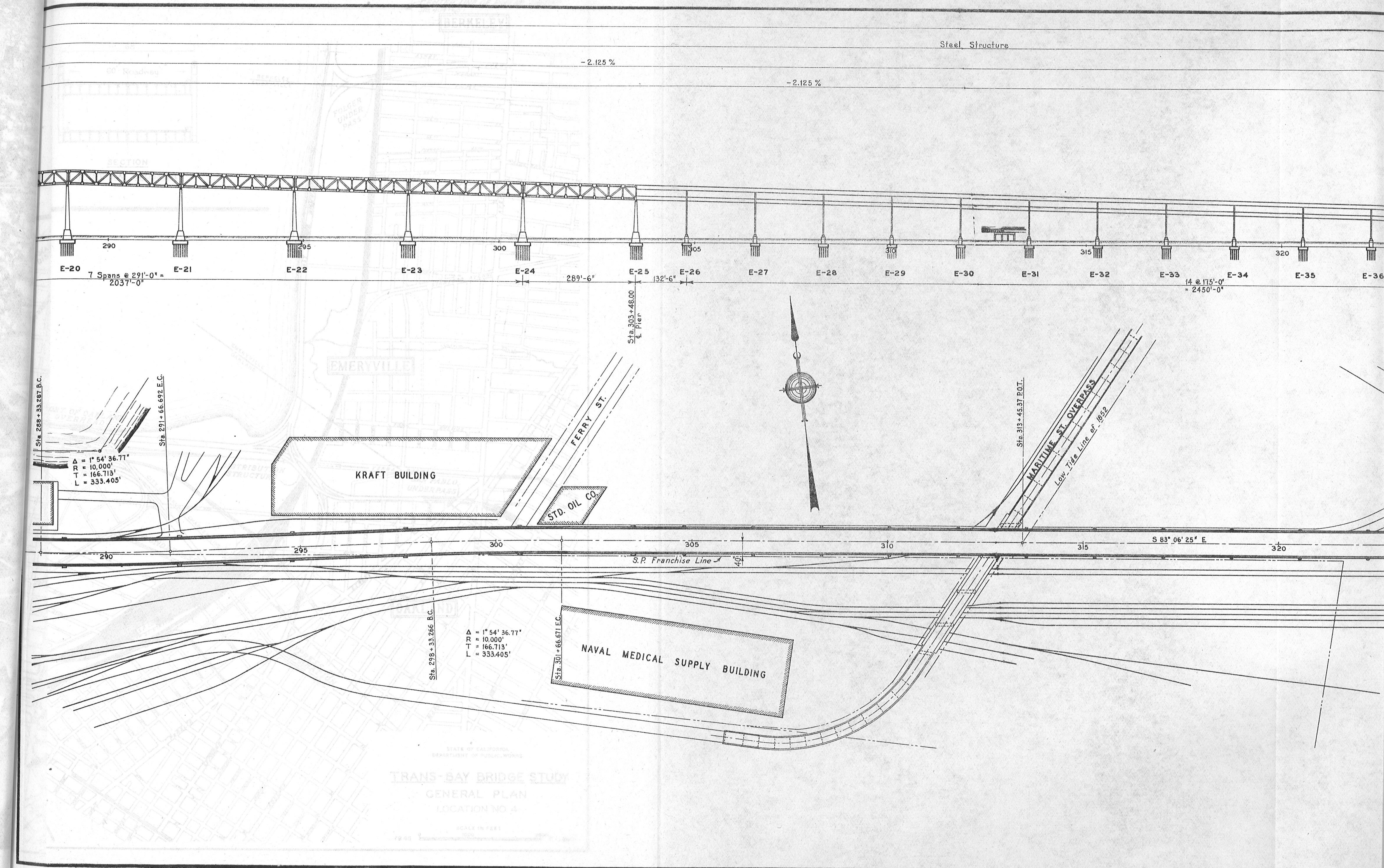

PLAZA 1200'
SAN FRANCISCO APPROACH 1800'
SAN FRANCISCO ANCHORAGE 870'
-5.0%
Level
400' V.C.
+2.94%
400' V.C.
+5.0%
+5.0%
300' V.C.
300' V.C.
+3.0%
+3.0%
℄ Stockton St.
℄ Grant Ave.
℄ Columbus Ave.
Sta. 35+00 B.V.C. El. 95.00 U.D.
℄ Kearny St.
Sta. 39+00 E.V.C. El. 100.88 U.D.
Sta. 45+00 B.V.C. El. 118.51 U.D.
Sta. 49+00 E.V.C. El. 134.44 U.D.
Sta. 54+86.91 B.V.C. El. 163.79 U.D. El. 139.79 L.D.
Sta. 57+86.91 E.V.C. El. 175.79 U.D. El. 151.79 L.D.
S.F. ANCHORAGE
W-1
289'-6"
111'-0"
289'-6"
22'-0"
1450'
Sta. 50+84.91 ℄ Bearing
Sta. 57+96.91 ℄ Bearing
ELEVATION
Δ = 17° 16' 10"
R = 1600'
T = 242.97'
L = 482.25
N. 63° 45' 50" E.
LEJO ST.
COLUMBUS AVE.
Sta. 36+43.81 B.C.
R = 1600'
Sta. 41+26.06 E.C.
WASHINGTON IRVING SCHOOL
ADWAY AVE.
R = 300'
R = 600'
FIC AVE.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
MONTGOMERY ST.
SANSOME ST.
BATTERY ST.
FRONT ST.
PLAN
Y.B. ANCH.
143'-1"
-3.00%
-3.00%
Sta. 145+00 B.V.C. El. 176.00 U.D. El. 152.00 L.D.
W-5
1450'
143'-1"
Sta. 144+96.91 ℄ Pin
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION NO. 3
SCALE IN FEET
0 100 200 300
1946
P-1843-57

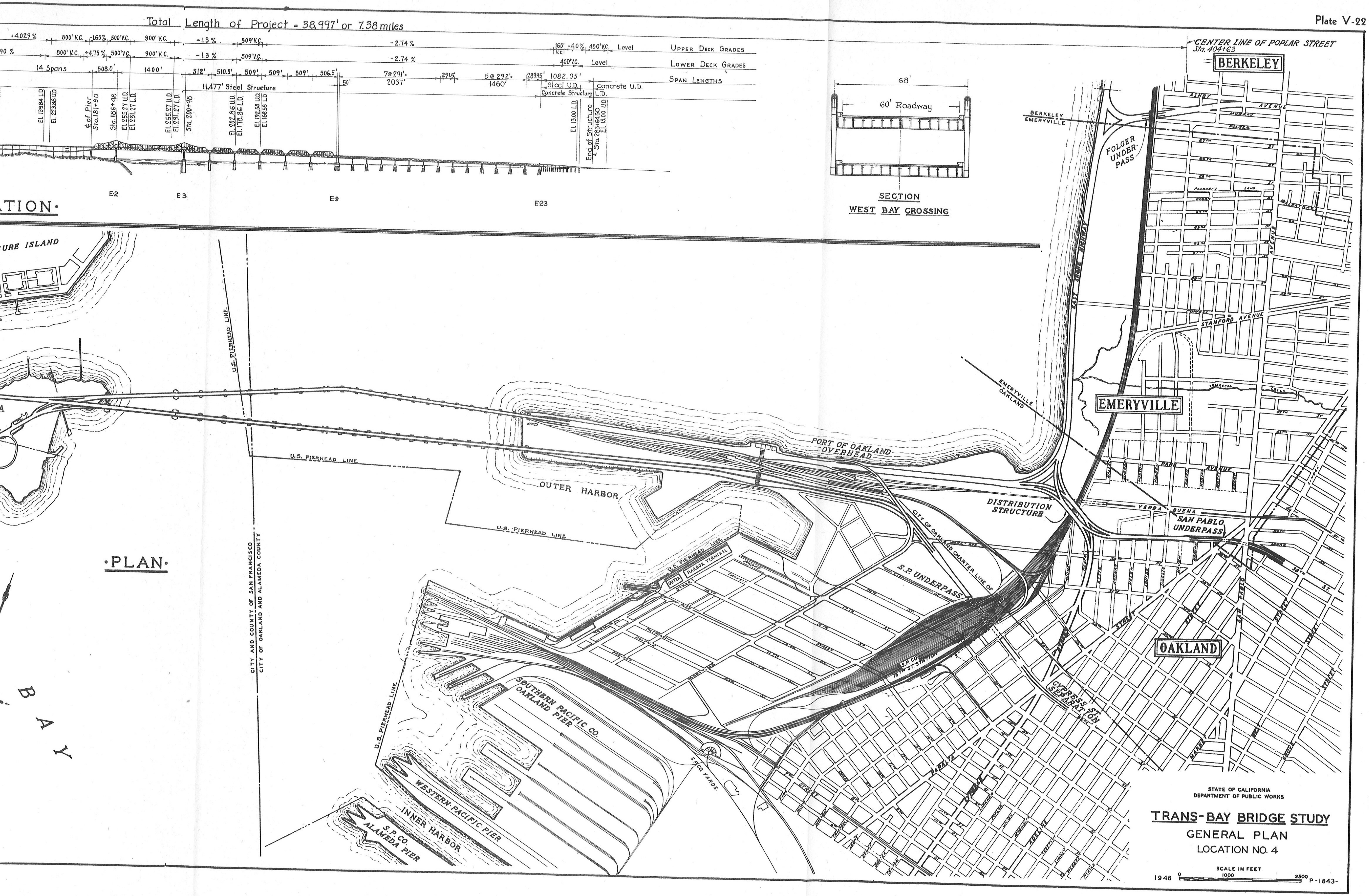

SAN FRANCISCO PLAZA 1200'
SAN FRANCISCO APPROACH 1800'
-5.0%
Level
400' V.C.
+2.94%
400' V.C.
℄ Powell St.
℄ Stockton St.
℄ Grant Ave.
℄ Columbus Ave.
Sta. 35+00 B.V.C.
El. 95.00 U.D.
℄ Kearny St.
Sta. 39+00 E.V.C.
El. 100.88 U.D.
Sta. 45+00 B.V.C.
El. 118.51 U.D.
Sta. 49+00 E.V.C.
El. 134.44 U.D.
S.F. ANCHORAGE
Sta. 50+84.91
℄ Bearing
ELEVATION
Δ = 17°16'10"
R = 1600'
T = 242.97'
L = 482.25
VALLEJO ST.
COLUMBUS AVE.
JEAN PARKER SCHOOL
N. 81°02' 00" E.
BROADWAY AVE.
Sta. 36+43.81 B.C.
R = 1600'
Sta. 41+26.06 E.C.
WASHINGTON IRVING SCHOOL
R = 300'
R = 600'
PACIFIC AVE.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST
MONTGOMERY ST.
SANSOME ST.
BATTERY ST.
PLAN

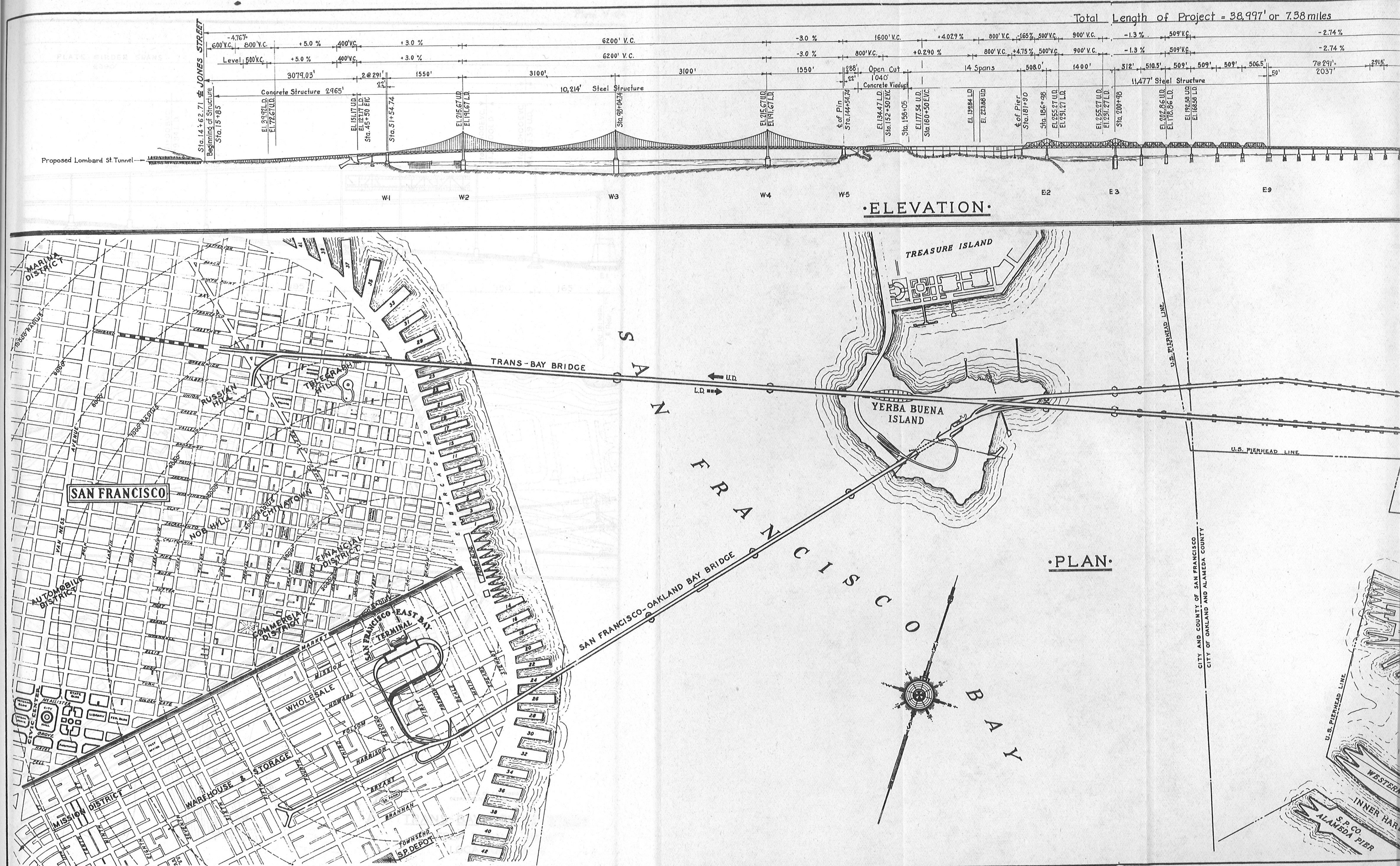

Concrete Structure
600'
200'
400' V.C.
- 4.00 %
350' V.C.
400' V.C.
-4.00 %
350' V.C.
Sta. 333+10.50 B.V.C.
El. 79.759 U.D.
Sta. 337+10.50 E.V.C.
El. 67.509 U.D.
23' Clearance
℄ Bay St.
℄ Cedar St.
15' Clearance
Sta. 342+10.67 B.V.C.
El. 33.881 L.D.
Sta. 342+50.50
℄ Pier
Sta. 346+10.67 P.R.V.C.
El. 21.631 L.D.
Sta. 348+57.45 B.V.C.
El. 21.631 U.D.
Sta. 349+60.67 E.V.C.
El. 14.631 L.D.
Sta. 350+50.50
Sta. 352+07.45 E.V.C.
El. 14.631 U.D.
Sta. 362+78.92
Sta. 364+49.28
330
335
340
345
350
355
360
365
E-41
E-42
E-43
E-44
E-59
Spans @ 100'-0" = 300'-0"
80'-0"
80'-0"
13 Spans @ 60'-0" = 780'-0"
80'-0"
15 Spans @ 40'-0" = 600'-0"
200'-0"
Concrete Walls
Plaza 1396'-9"
On Ramp
15 Spans @ 60'-0" = 900'-0"
10 Spans @ 40'-0" = 400'-0"
200'-0"
Concrete Walls
Plaza 1468'-3"
Off Ramp
SOUTHERN PACIFIC MAIN LINE TRACKS
BWAY
Sta. 335+56.20 E.C.
EIGHTH ST.
S 88° 16' 30.48" E
Sta. 344+75.33 B.C.
Δ = 13° 47' 14.48"
R = 5000'
T = 604.556'
L = 1203.174'
Sta. 356+78.50 E.C.
S 74° 29' 16" E
Sta. 364+49.28
ADMINISTRATION BUILDINGS
AND TOLL PLAZA
PERALTA ST.
S 76° 38' 45.42" E
Sta. 336+68.73 E.C.
BAY ST.
Sta. 348+35.41 B.C.
Δ = 2° 09' 29.42"
R = 10,000'
T = 188.358'
L = 376.672'
Sta. 352+12.08 E.C.
S 74° 29' 16" E
Sta. 362+78.92
FIFTH ST.
CEDAR ST.
PINE ST.
WOOD ST.
WILLOW ST.
CAMPBELL ST.
Δ = 6° 27' 39.58"
R = 10,000'
T = 564.426'
L = 1127.657'
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
OAKLAND LAYOUT
LOCATION No. 3
SCALE IN FEET
100 0 100 200
1946
P-1843-



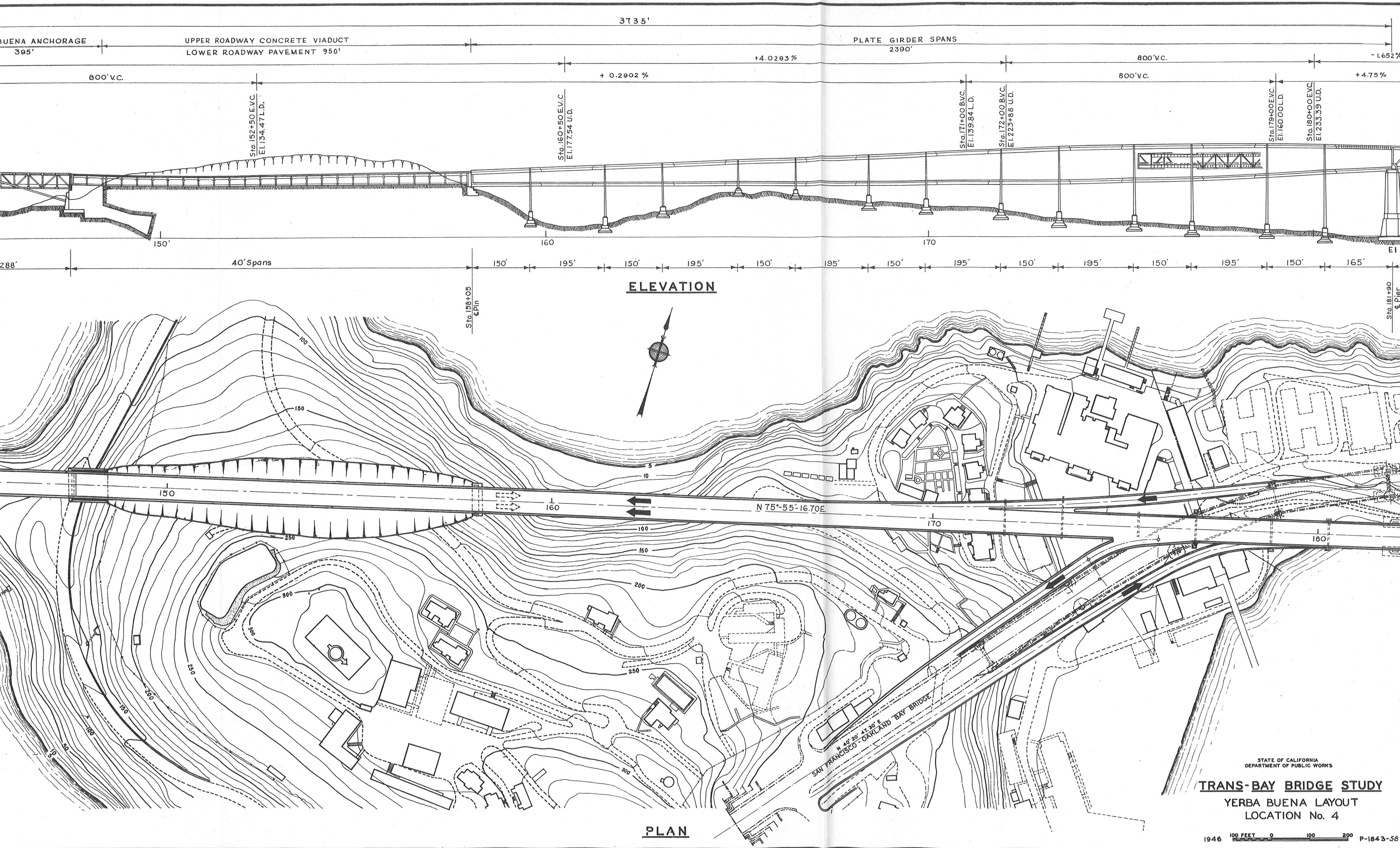
Steel Structure
-2.125 %
-2.125 %
400' V.C.
Sta. 333+10.50 B.V.C.
El. 79.759 U.D.
23' Clearance
E-24
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
E-37
E-38
E-39
E-40
E-41
E-42
E-43
E-44
289'-6"
132'-6"
14 @ 175'-0" = 2450'-0"
3 Spans @ 100'-0" = 300'-0"
80'-0"
80'-0"
Sta. 303+48.00
℄ Pier
ELEVATION
FERRY ST.
STD. OIL CO.
Sta. 313+45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
Sta. 326+54.18 B.C.
Δ = 5° 10' 05.48"
R = 10,000'
T = 451.316'
L = 902.019'
SEVENTH ST. SUBWAY
SOUTHERN PACIFIC MAIN LINE TRACKS
Sta. 335+56.20 E.C.
S 83° 06' 25" E
S.P. Franchise Line
40'
Sta. 298+33.266 B.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
Sta. 301+66.671 E.C.
NAVAL MEDICAL SUPPLY BUILDING
Sta. 325+41.07 B.C.
Δ = 6° 27' 39.58"
R = 10,000'
T = 564.426'
L = 1127.657'
PLAN
BERKELEY


Steel Structure
-2.125 %
-2.125 %
290
295
300
305
310
315
320
E-20
E-21
E-22
E-23
E-24
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
7 Spans @ 291'-0" = 2037'-0"
289'-6"
132'-6"
14 @ 175'-0" = 2450'-0"
Sta. 303+48.00 ℄ Pier
Sta. 288+33.287 B.C.
Sta. 291+66.692 E.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
KRAFT BUILDING
FERRY ST.
STD. OIL CO.
Sta. 313+45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
S 83° 06' 25" E
S.P. Franchise Line
40'
Sta. 298+33.266 B.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
Sta. 301+66.671 E.C.
NAVAL MEDICAL SUPPLY BUILDING

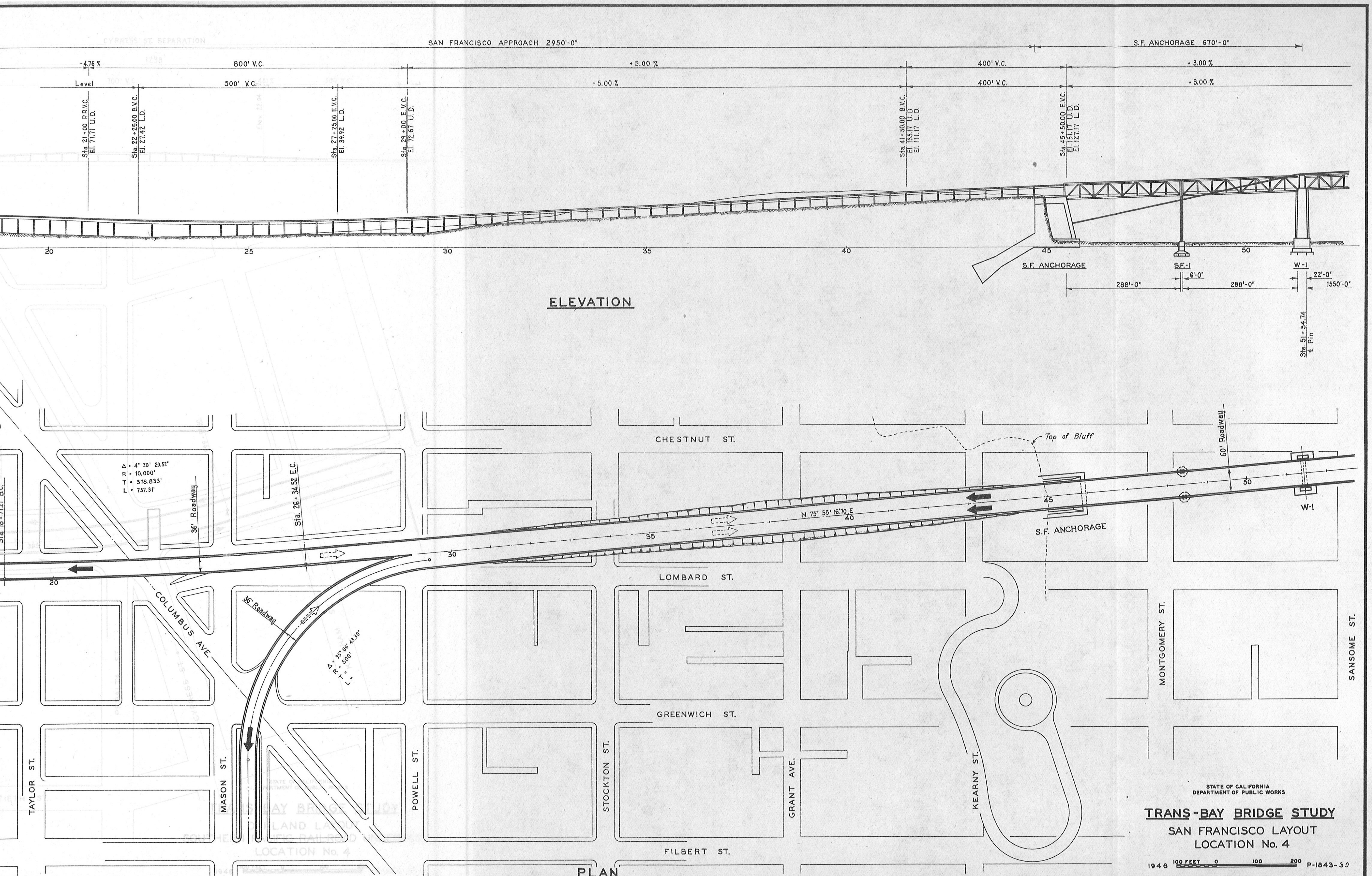

Total Length of Project = 38,997' or 7.38 miles
Upper Deck Grades
Lower Deck Grades
Span Lengths
14 Spans
11,477' Steel Structure
Steel U.D.
Concrete U.D.
Concrete Structure L.D.
-2.74 %
7@291' = 2037'
5@292' = 1460'
1082.05'
E2
E3
E9
E23
ATION
68'
60' Roadway
SECTION
WEST BAY CROSSING
CENTER LINE OF POPLAR STREET
Sta. 404+63
BERKELEY
EMERYVILLE
OAKLAND
FOLGER UNDER-PASS
EAST SHORE HIGHWAY
STANFORD AVENUE
ASHBY AVENUE
PARK AVENUE
YERBA BUENA
SAN PABLO UNDERPASS
DISTRIBUTION STRUCTURE
PORT OF OAKLAND OVERHEAD
OUTER HARBOR
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
S.P. UNDERPASS
CITY OF OAKLAND CHARTER LINE
CYPRESS ST. SEPARATION
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
S.P. CO. YARDS
S.P. CO. 16TH ST. STATION
TREASURE ISLAND
PLAN
BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 4
SCALE IN FEET
0 1000 2500
1946
P-1843-

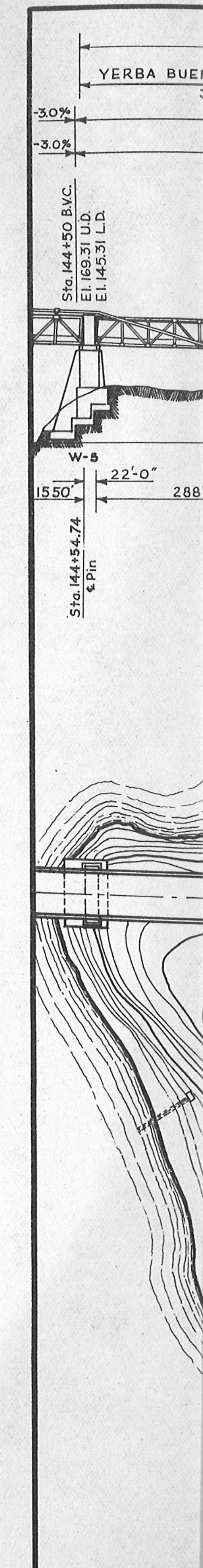


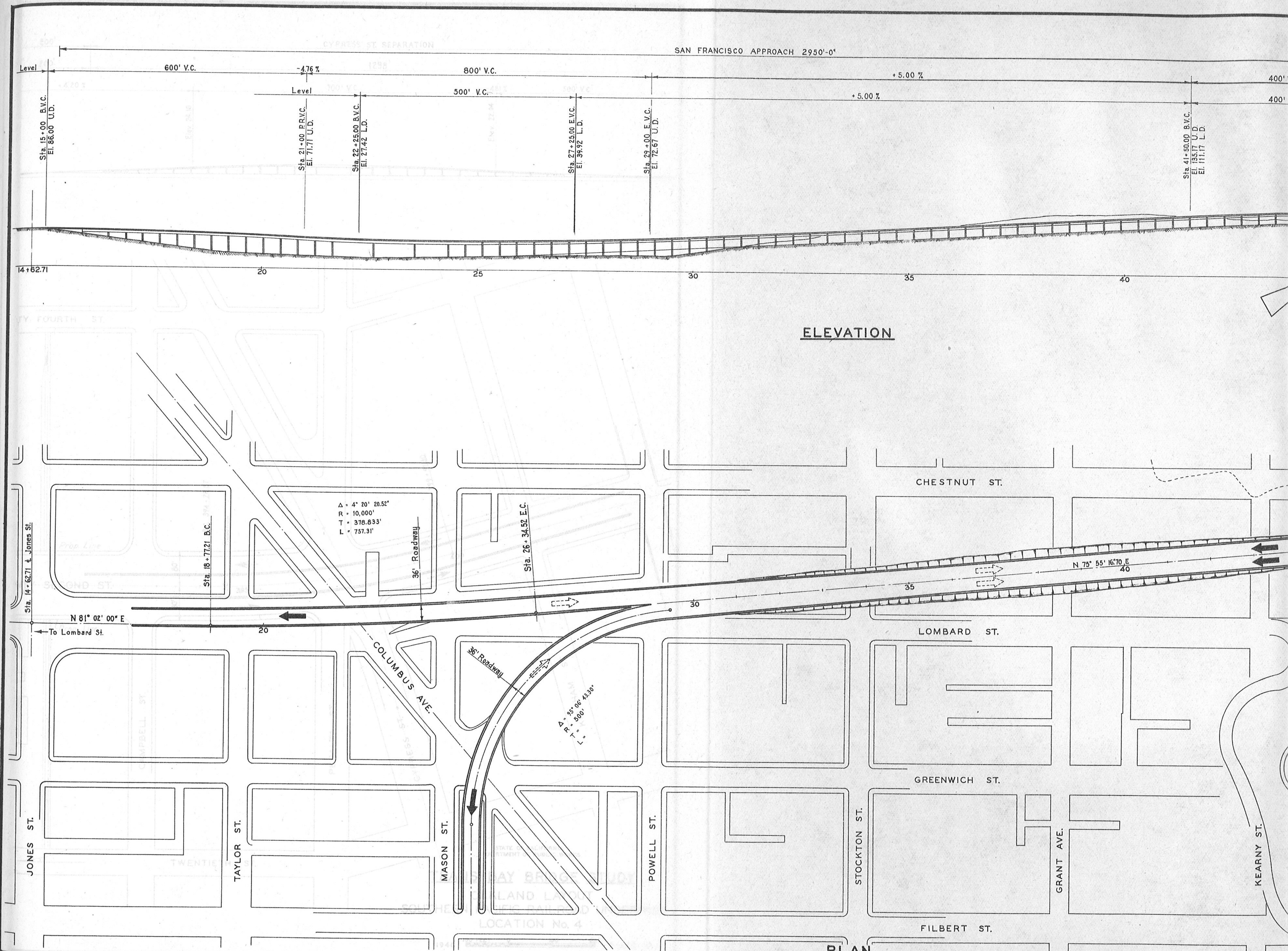
Total Length of Project = 38,997' or 7.38 miles
Sta. 14+62.71 ℄ JONES STREET
Beginning of Structure
Sta. 15+85
Concrete Structure 2965'
10,214' Steel Structure
11,477' Steel Structure
14 Spans
Open Cut
Concrete Viaduct
Proposed Lombard St. Tunnel
W-1
W-2
W-3
W-4
W-5
E2
E3
E9
·ELEVATION·
TREASURE ISLAND
YERBA BUENA ISLAND
TRANS-BAY BRIDGE
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN FRANCISCO BAY
·PLAN·
SAN FRANCISCO
MARINA DISTRICT
RUSSIAN HILL
TELEGRAPH HILL
NOB HILL
CHINATOWN
FINANCIAL DISTRICT
COMMERCIAL DISTRICT
AUTOMOBILE DISTRICT
SAN FRANCISCO-EAST BAY TERMINAL
WHOLESALE
WAREHOUSE & STORAGE
MISSION DISTRICT
CIVIC CENTER
S.P. DEPOT
EMBARCADERO
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
INNER HARBOR
S.P. CO. ALAMEDA PIER



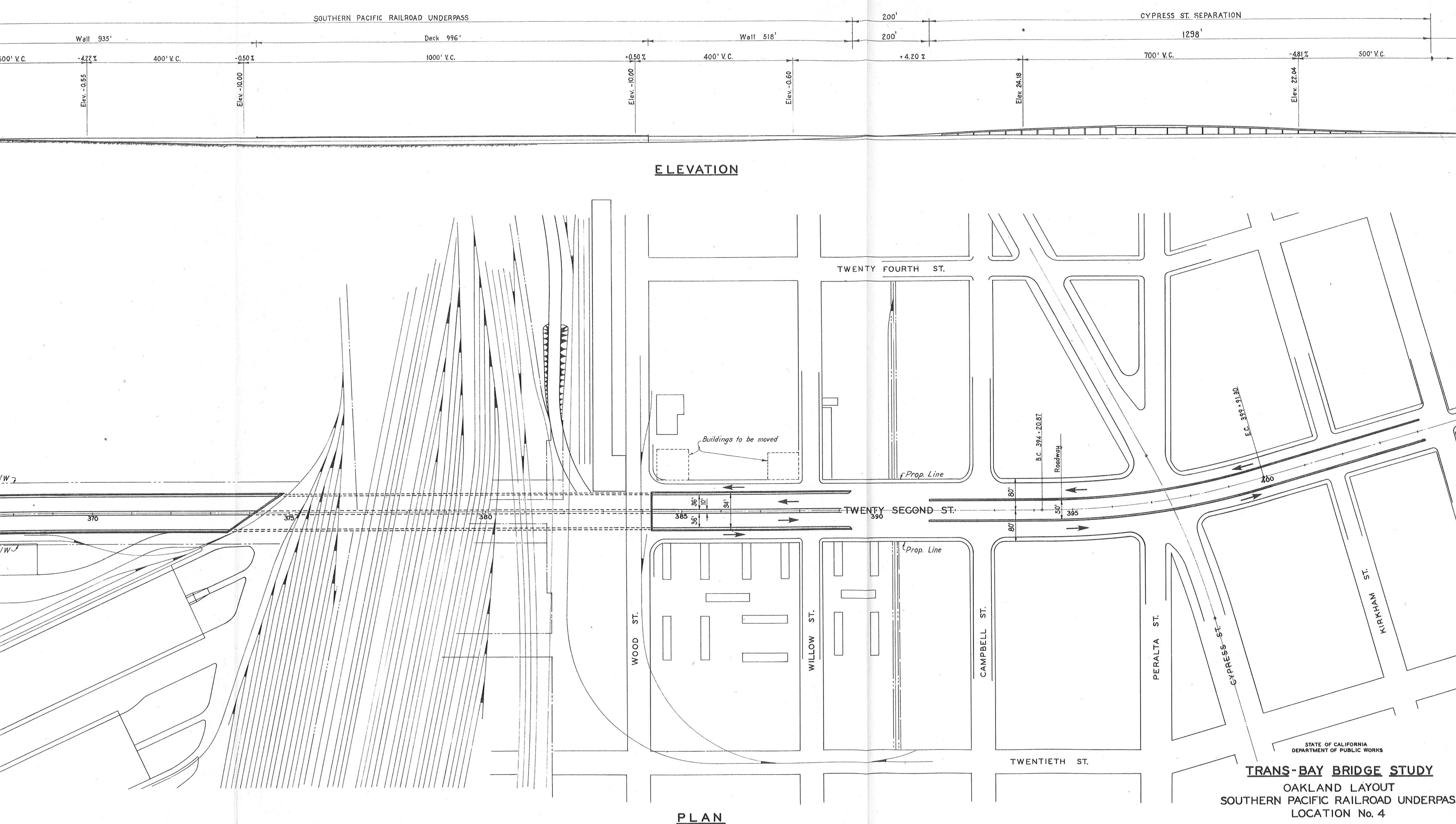
3735'
BUENA ANCHORAGE
395'
UPPER ROADWAY CONCRETE VIADUCT
LOWER ROADWAY PAVEMENT 950'
PLATE GIRDER SPANS
2390'
+4.0293%
800'V.C.
-1.652%
800'V.C.
+0.2902%
800'V.C.
+4.75%
Sta. 152+50 E.V.C.
El. 134.47 L.D.
Sta. 160+50 E.V.C.
El. 177.54 U.D.
Sta. 171+00 B.V.C.
El. 139.84 L.D.
Sta. 172+00 B.V.C.
El. 223+88 U.D.
Sta. 179+00 E.V.C.
El. 160.00 L.D.
Sta. 180+00 E.V.C.
El. 233.39 U.D.
150'
160
170
E1
288'
40' Spans
150'
195'
150'
195'
150'
195'
150'
195'
150'
195'
150'
195'
150'
165'
ELEVATION
Sta. 158+05 ℄ Pin
Sta. 181+90 ℄ Pier
150
160
N 75°-55'-16.70 E.
170
180
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-58


SAN FRANCISCO APPROACH 2950'-0"
S.F. ANCHORAGE 670'-0"
800' V.C.
500' V.C.
400' V.C.
+5.00 %
+3.00 %
-4.76 %
Level
Sta. 21+00 P.R.V.C. El. 71.71 U.D.
Sta. 22+25.00 B.V.C. El. 27.42 L.D.
Sta. 27+25.00 E.V.C. El. 39.92 L.D.
Sta. 29+00 E.V.C. El. 72.67 U.D.
Sta. 41+50.00 B.V.C. El. 135.17 U.D. El. 111.17 L.D.
Sta. 45+50.00 E.V.C. El. 151.17 U.D. El. 127.17 L.D.
S.F. ANCHORAGE
S.F.-1
W-1
288'-0"
6'-0"
22'-0"
1550'-0"
Sta. 51+54.74 ℄ Pin
ELEVATION
CHESTNUT ST.
Top of Bluff
60' Roadway
Δ = 4° 20' 20.52"
R = 10,000'
T = 378.833'
L = 757.31'
Sta. 26+34.52 E.C.
36' Roadway
N 75° 55' 16.70 E
S.F. ANCHORAGE
W-1
LOMBARD ST.
COLUMBUS AVE.
36' Roadway
Δ = 95° 00' 43.30"
R = 500'
MONTGOMERY ST.
SANSOME ST.
GREENWICH ST.
TAYLOR ST.
MASON ST.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
FILBERT ST.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-39


YERBA BUE
-3.0%
-3.0%
Sta. 144+50 B.V.C. El. 169.31 U.D. El. 145.31 L.D.
W-5
22'-0"
1550'
288
Sta. 144+54.74 ℄ Pin



SAN FRANCISCO APPROACH 2950'-0"
Level
600' V.C.
-4.76 %
800' V.C.
+5.00 %
400'
Level
500' V.C.
+5.00 %
Sta. 15+00 B.V.C. El. 86.00 U.D.
Sta. 21+00 P.R.V.C. El. 71.71 U.D.
Sta. 22+25.00 B.V.C. El. 27.42 L.D.
Sta. 27+25.00 E.V.C. El. 39.92 L.D.
Sta. 29+00 E.V.C. El. 72.67 U.D.
Sta. 41+50.00 B.V.C. El. 135.17 U.D. El. 111.17 L.D.
14+62.71
20
25
30
35
40
ELEVATION
CHESTNUT ST.
LOMBARD ST.
GREENWICH ST.
FILBERT ST.
JONES ST.
TAYLOR ST.
MASON ST.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
COLUMBUS AVE.
Sta. 14+62.71 ℄ Jones St.
To Lombard St.
N 81° 02' 00" E
Sta. 18+77.21 B.C.
Δ = 4° 20' 20.52"
R = 10,000'
T = 378.833'
L = 757.31'
36' Roadway
Sta. 26+34.52 E.C.
36' Roadway
Δ = 95° 06' 43.30"
R = 500'
T =
L =
N 75° 55' 16.70 E
PLAN

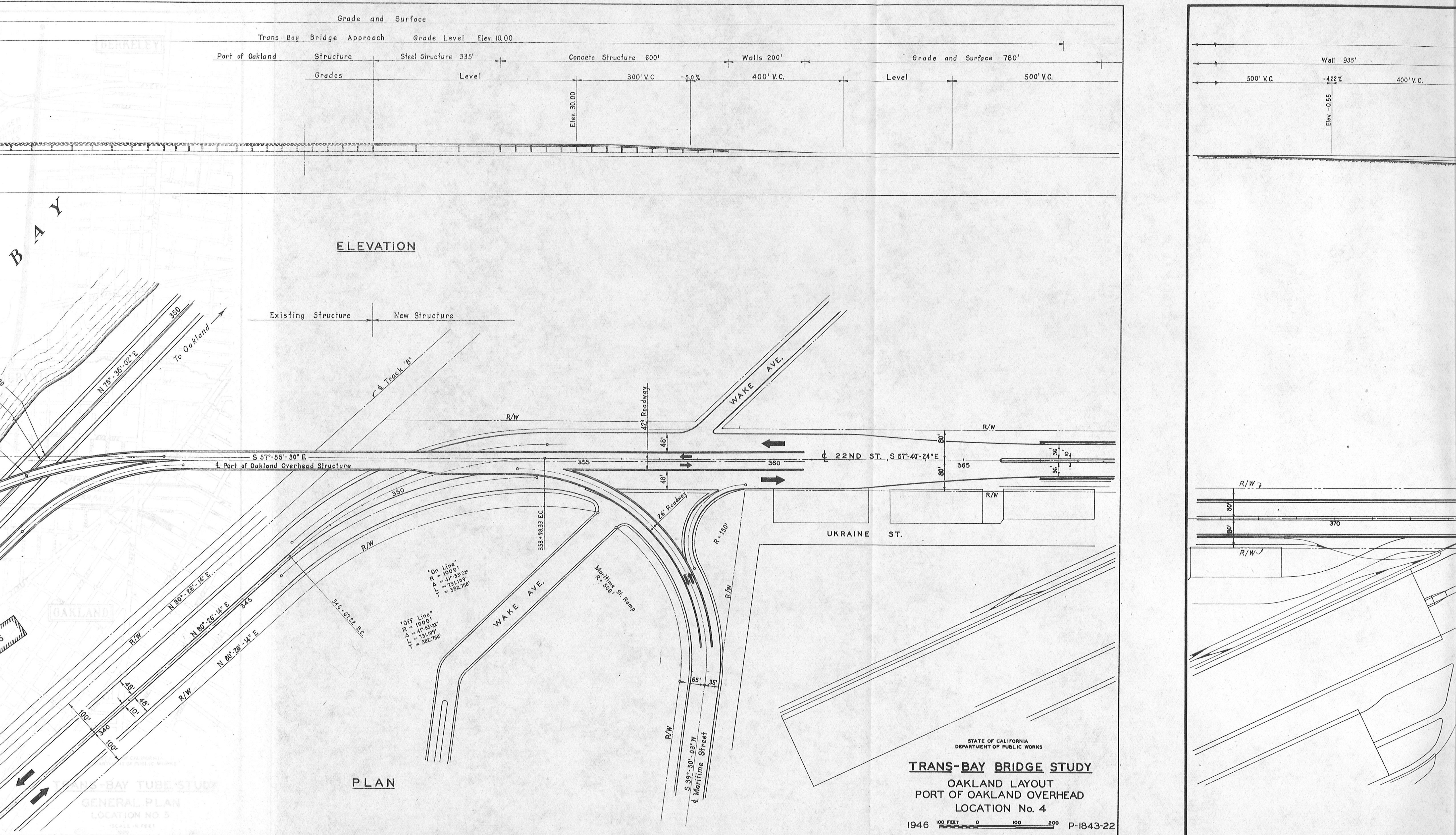


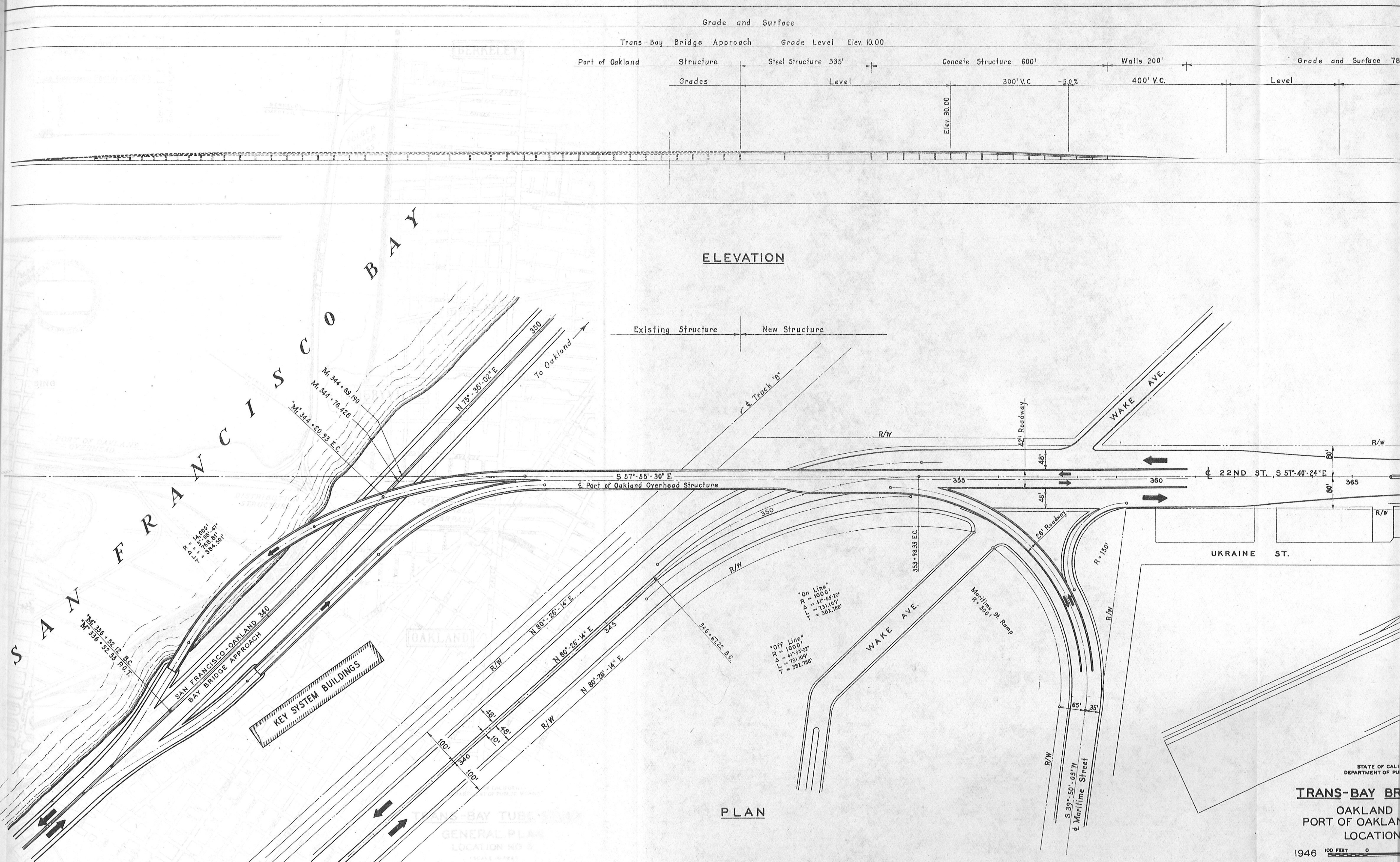
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

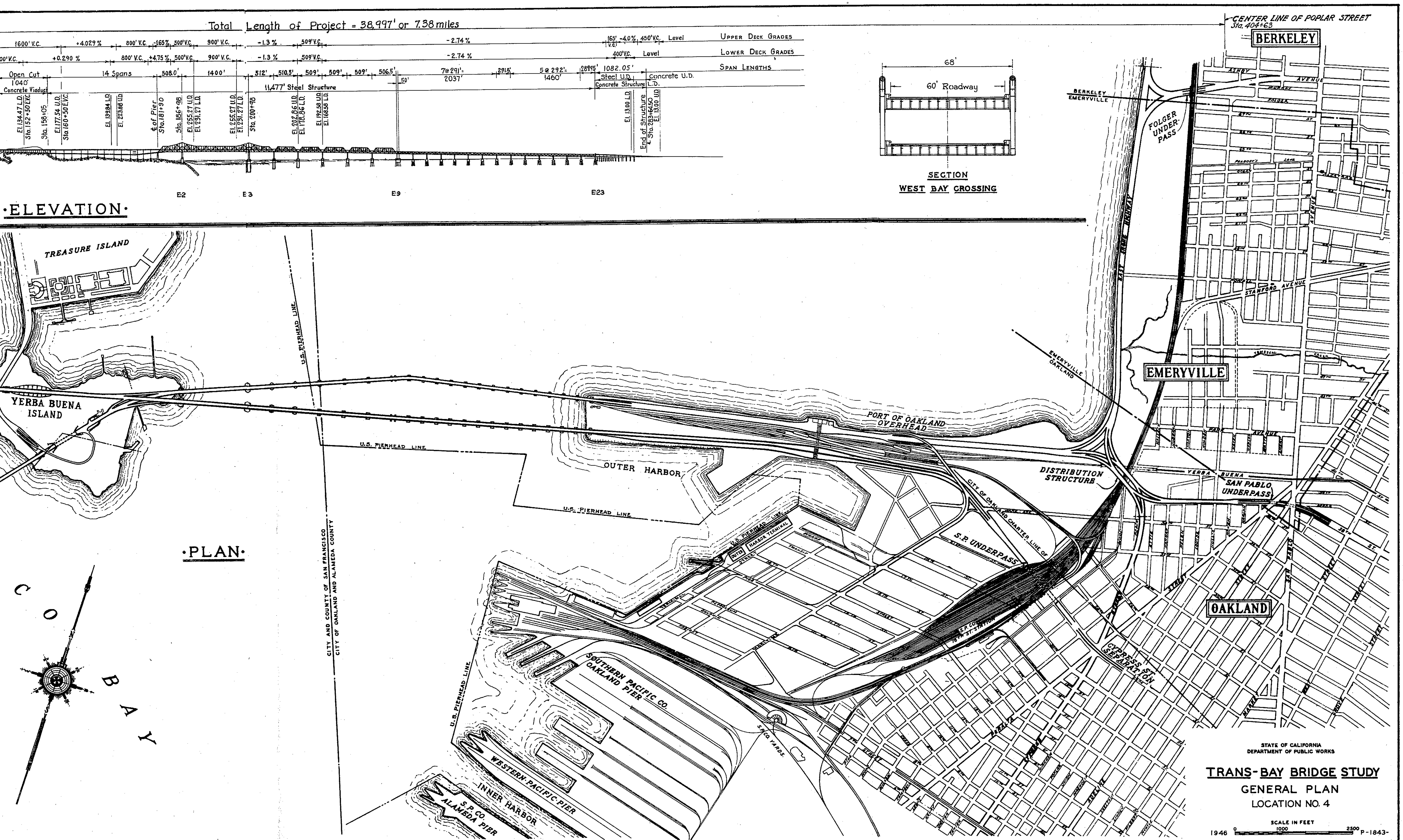
TRANS-BAY BRIDGE STUDY

OAKLAND LAYOUT
SOUTHERN PACIFIC RAILROAD UNDERPASS
LOCATION No. 4

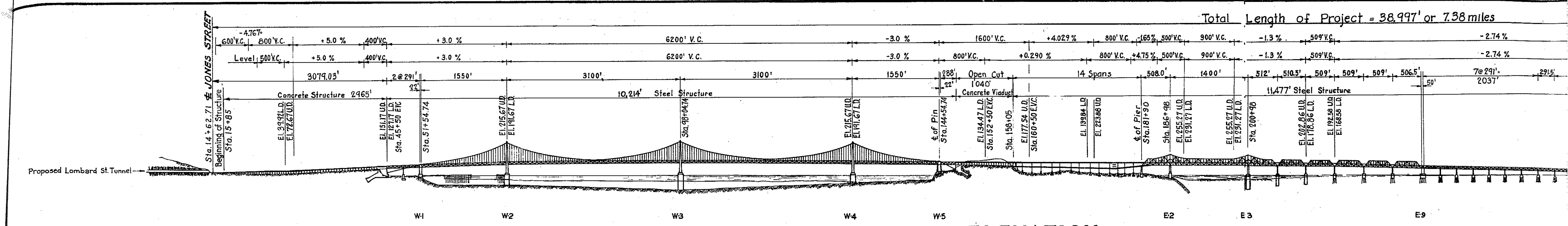
1946 100 FEET 0 100 200 P-1843-23


Grade and Surface
Trans-Bay Bridge Approach
Grade Level Elev. 10.00
Port of Oakland
Structure
Steel Structure 335'
Concete Structure 600'
Walls 200'
Grade and Surface 780'
Grades
Level
300' V.C
-5.0%
400' V.C.
Level
500' V.C.
Elev. 30.00
ELEVATION
Existing Structure
New Structure
B A Y
To Oakland
N 75°-38'-02" E
S 57°-55'-30" E
℄ Port of Oakland Overhead Structure
℄ 22ND ST. S 57°-40'-24" E
WAKE AVE.
42' Roadway
26' Roadway
R/W
UKRAINE ST.
"On Line"
"Off Line"
Maritime St. Ramp
S 39°-50'-03" W
℄ Maritime Street
N 80°-26'-14" E
PLAN
Wall 935'
500' V.C.
-4.22%
400' V.C.
Elev. -0.55
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
OAKLAND LAYOUT
PORT OF OAKLAND OVERHEAD
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-22

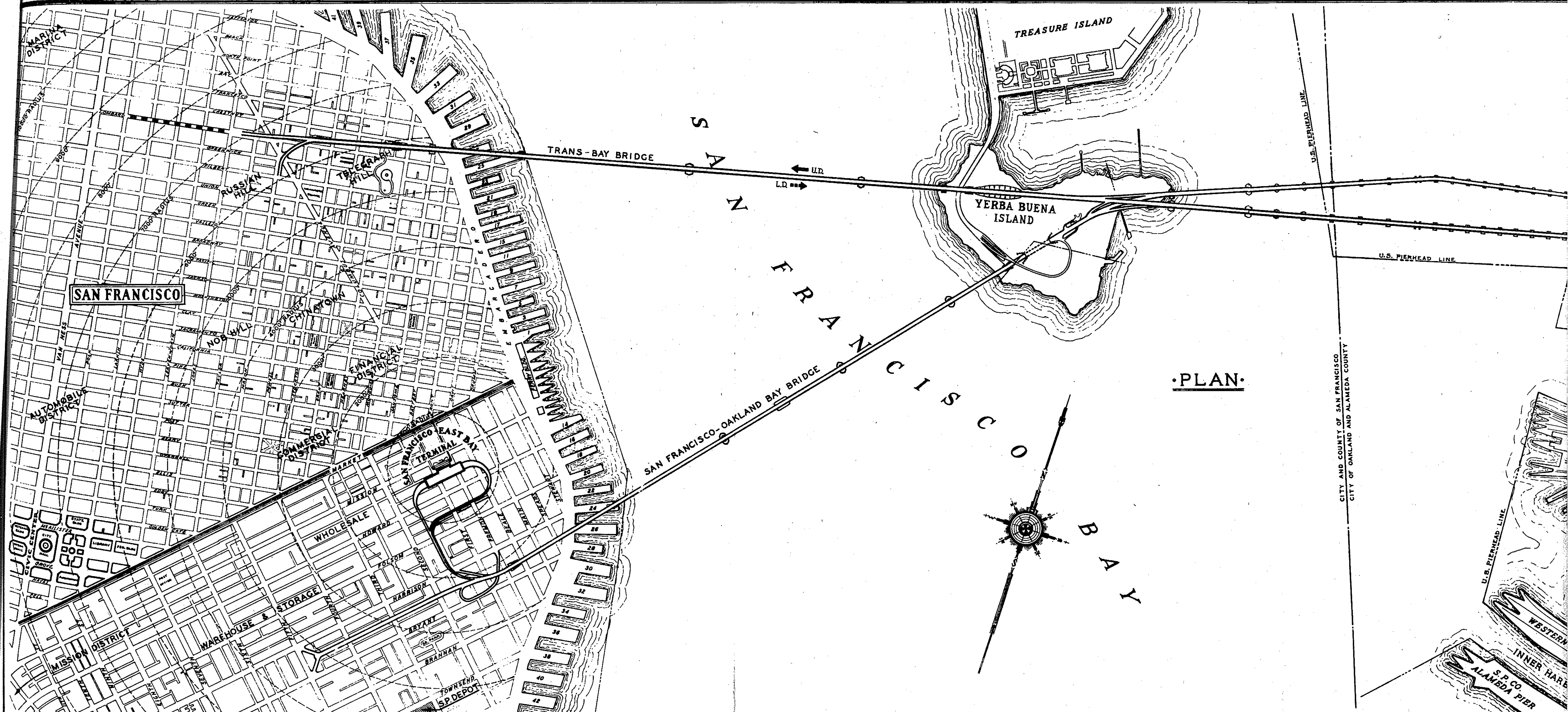

Grade and Surface
Trans-Bay Bridge Approach
Grade Level Elev. 10.00
Port of Oakland
Structure
Steel Structure 335'
Concete Structure 600'
Walls 200'
Grade and Surface 78
Grades
Level
300' V.C.
-5.0%
400' V.C.
Level
Elev. 30.00
ELEVATION
SAN FRANCISCO BAY
Existing Structure
New Structure
To Oakland
N 75°-38'-02" E
350
M. 344 + 88.190
M. 344 + 76.428
"M" 344 + 20.93 E.C.
℄ Track "B"
R/W
WAKE AVE.
42' Roadway
48'
S 57°-55'-30" E
℄ Port of Oakland Overhead Structure
355
360
℄ 22ND ST. S 57°-40'-24" E
80'
365
R/W
UKRAINE ST.
26' Roadway
R = 150'
R = 14,000'
Δ = 3°-08'-47"
L = 768.81'
T = 384.501'
"M" 336 + 52.12 B.C.
"M" 336 + 52.33 P.O.T.
SAN FRANCISCO-OAKLAND 340
BAY BRIDGE APPROACH
KEY SYSTEM BUILDINGS
N 80°-26'-14" E
345
346 + 67.22 B.C.
353 + 98.33 E.C.
"On Line"
R = 1000'
Δ = 41°-35'-22"
L = 731.109'
T = 382.756'
"Off Line"
R = 1000'
Δ = 41°-35'-22"
L = 731.109'
T = 382.756'
WAKE AVE.
Maritime St. Ramp
R = 500'
65'
35'
S 39°-50'-03" W
℄ Maritime Street
100'
340
10'
PLAN
STATE OF CALI
DEPARTMENT OF PU
TRANS-BAY BR
OAKLAND
PORT OF OAKLAN
LOCATION
1946
100 FEET 0



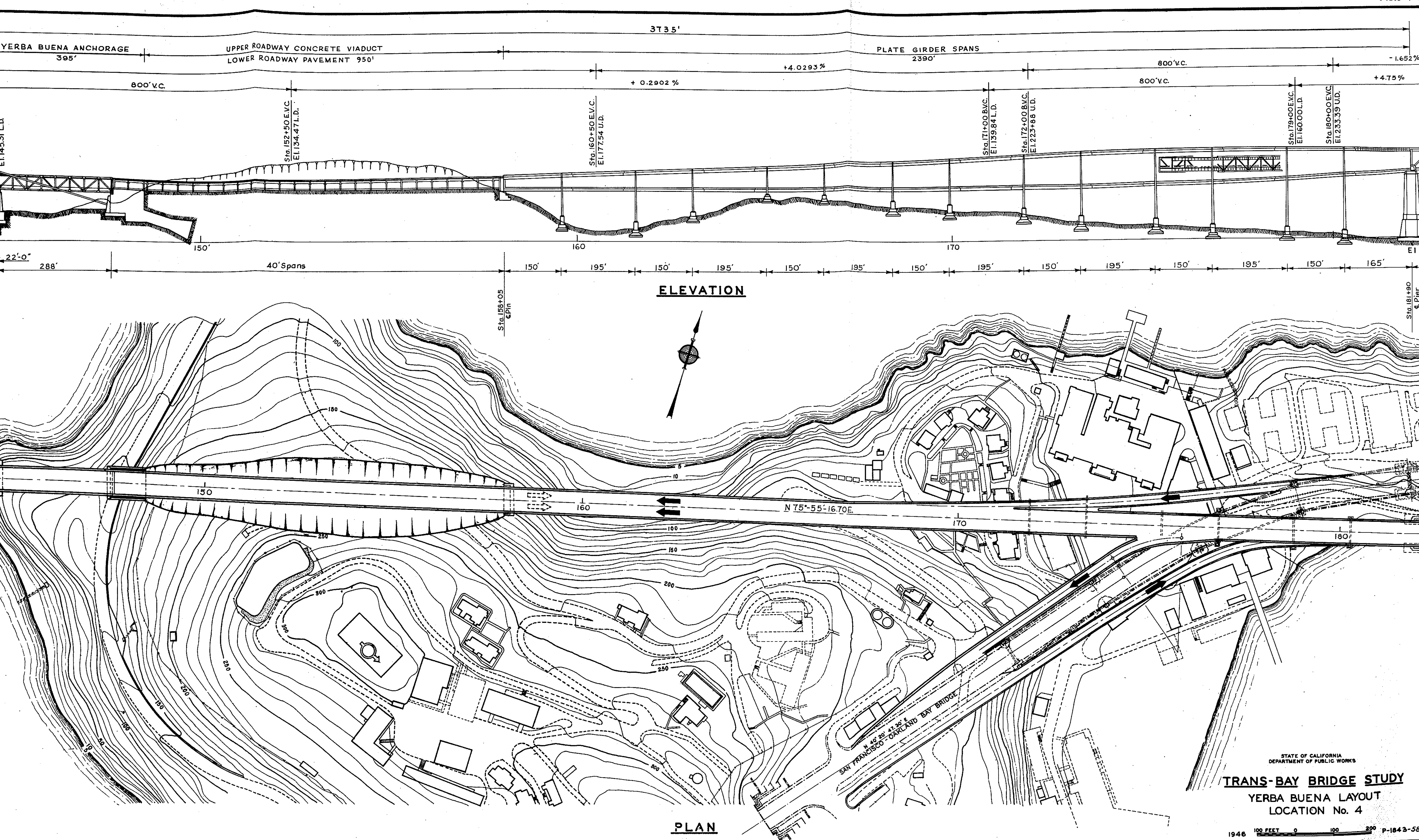
Total Length of Project = 38,997' or 7.38 miles
Upper Deck Grades
Lower Deck Grades
Span Lengths
14 Spans
11,477' Steel Structure
Open Cut
Concrete Viaduct
Steel U.D.
Concrete Structure L.D.
Concrete U.D.
CENTER LINE OF POPLAR STREET
Sta. 404+63
·ELEVATION·
68'
60' Roadway
SECTION
WEST BAY CROSSING
TREASURE ISLAND
YERBA BUENA ISLAND
·PLAN·
U.S. PIERHEAD LINE
OUTER HARBOR
PORT OF OAKLAND OVERHEAD
DISTRIBUTION STRUCTURE
S.P. UNDERPASS
CITY OF OAKLAND CHARTER LINE
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
CYPRESS ST. SEPARATION
SAN PABLO UNDERPASS
FOLGER UNDERPASS
BERKELEY
EMERYVILLE
OAKLAND
BERKELEY
EMERYVILLE
EMERYVILLE
OAKLAND
STANFORD AVENUE
ASHBY AVENUE
YERBA BUENA
C O BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 4
SCALE IN FEET
1946
P-1843-

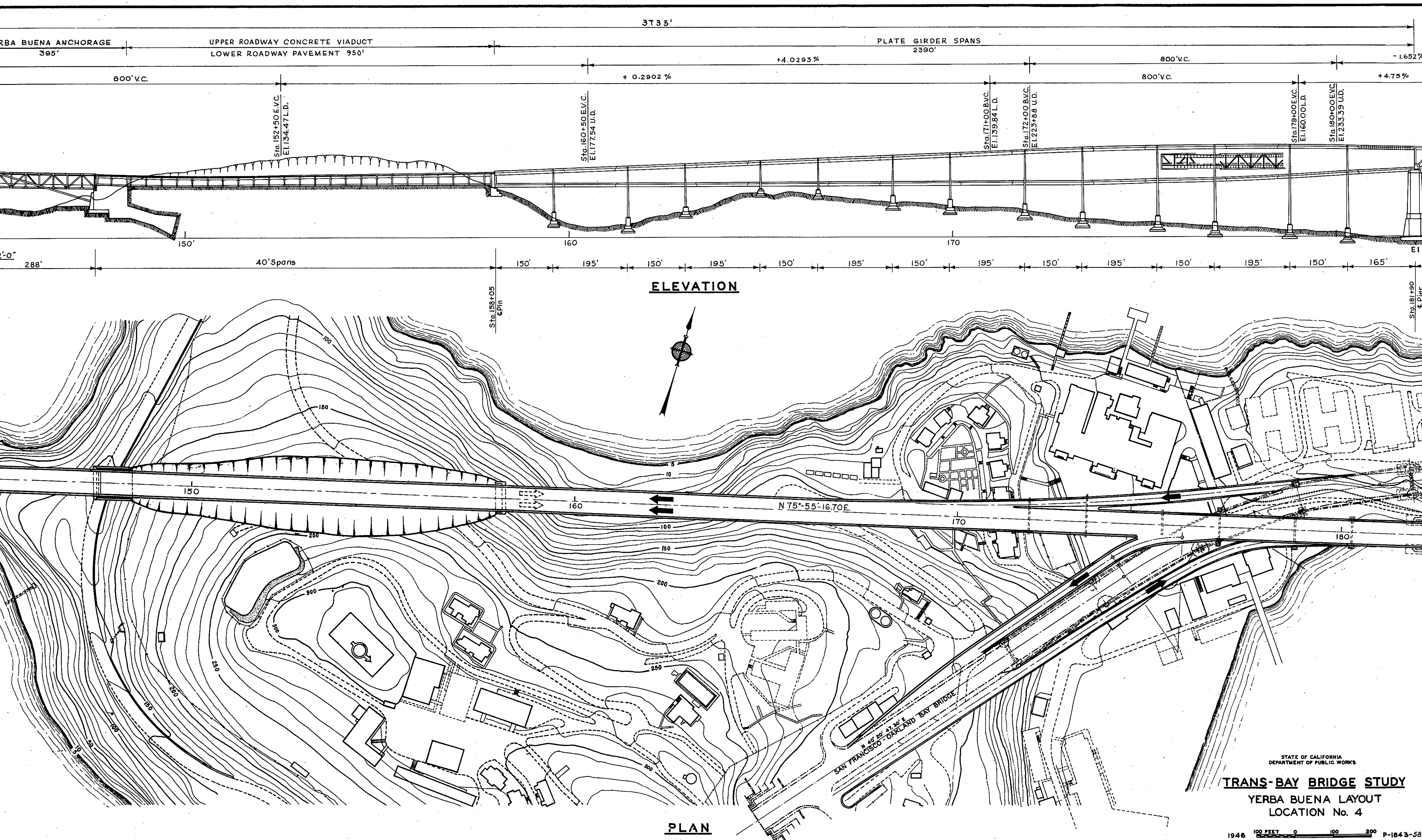


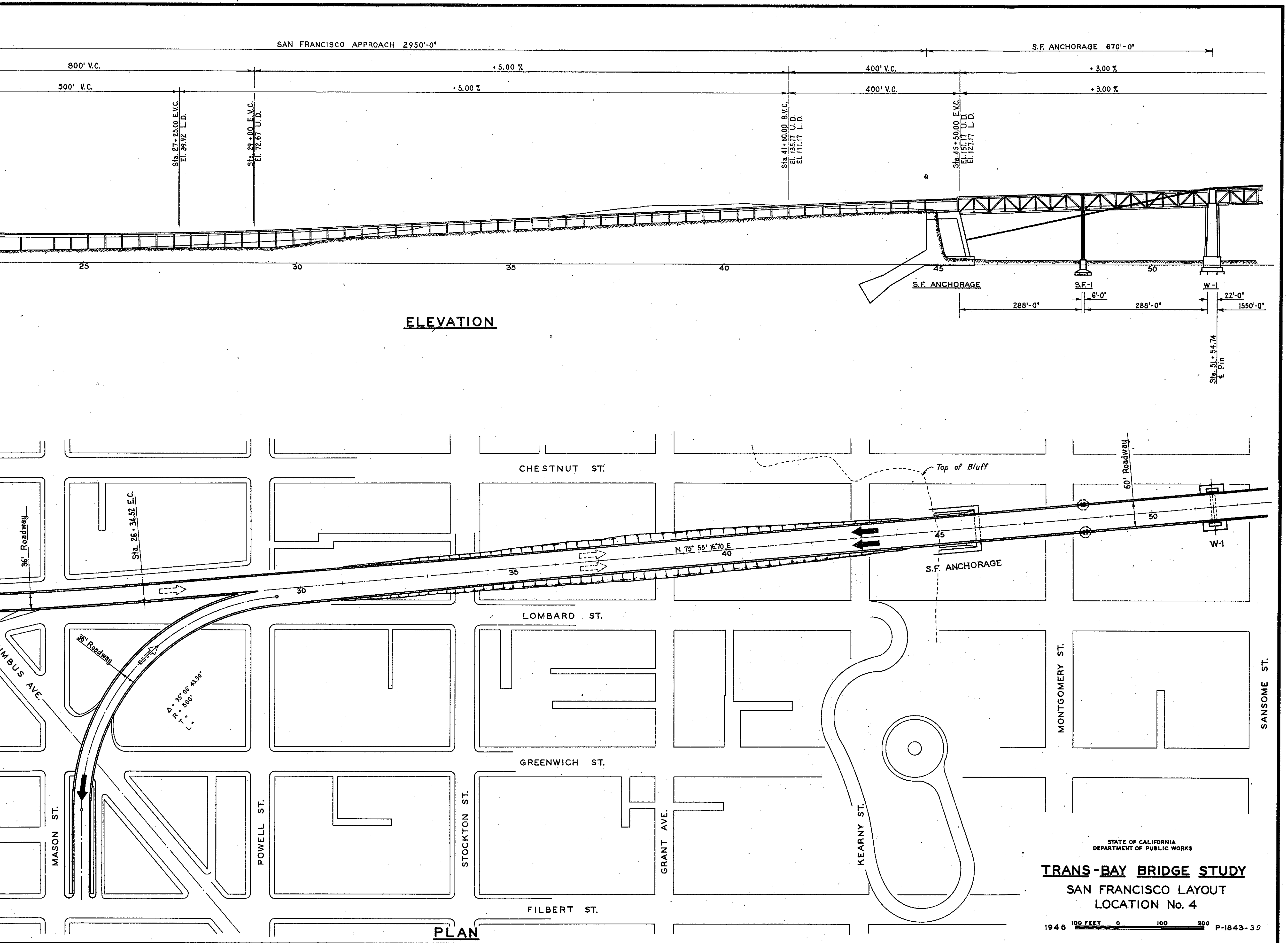
·ELEVATION·

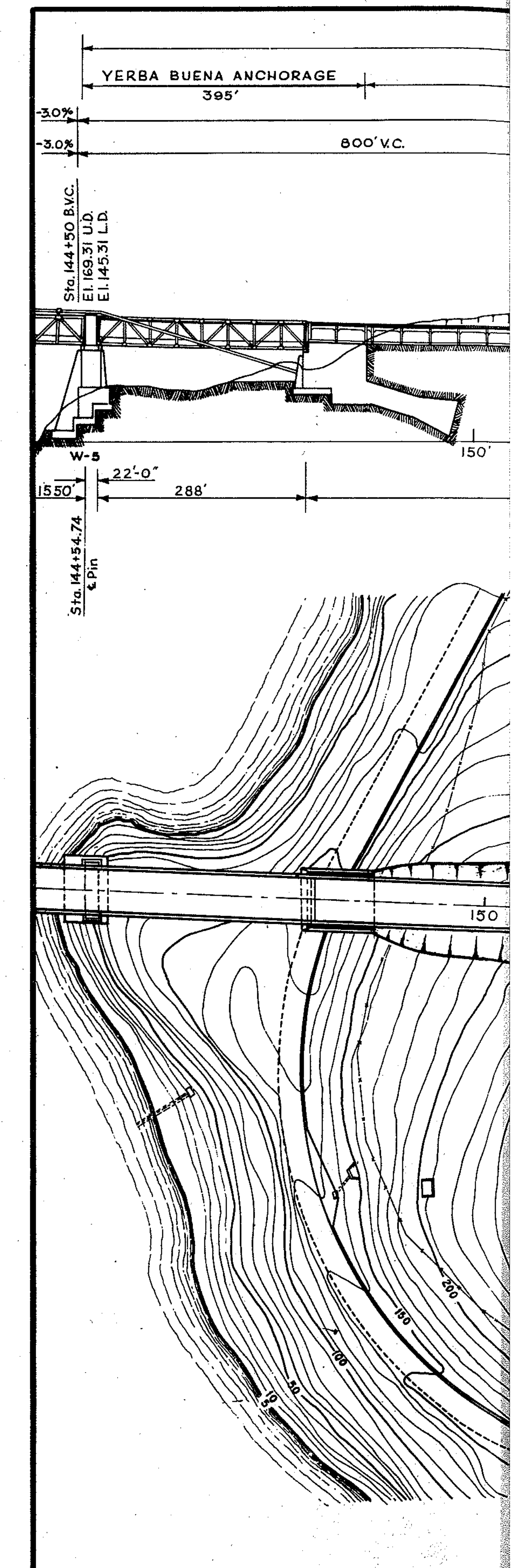


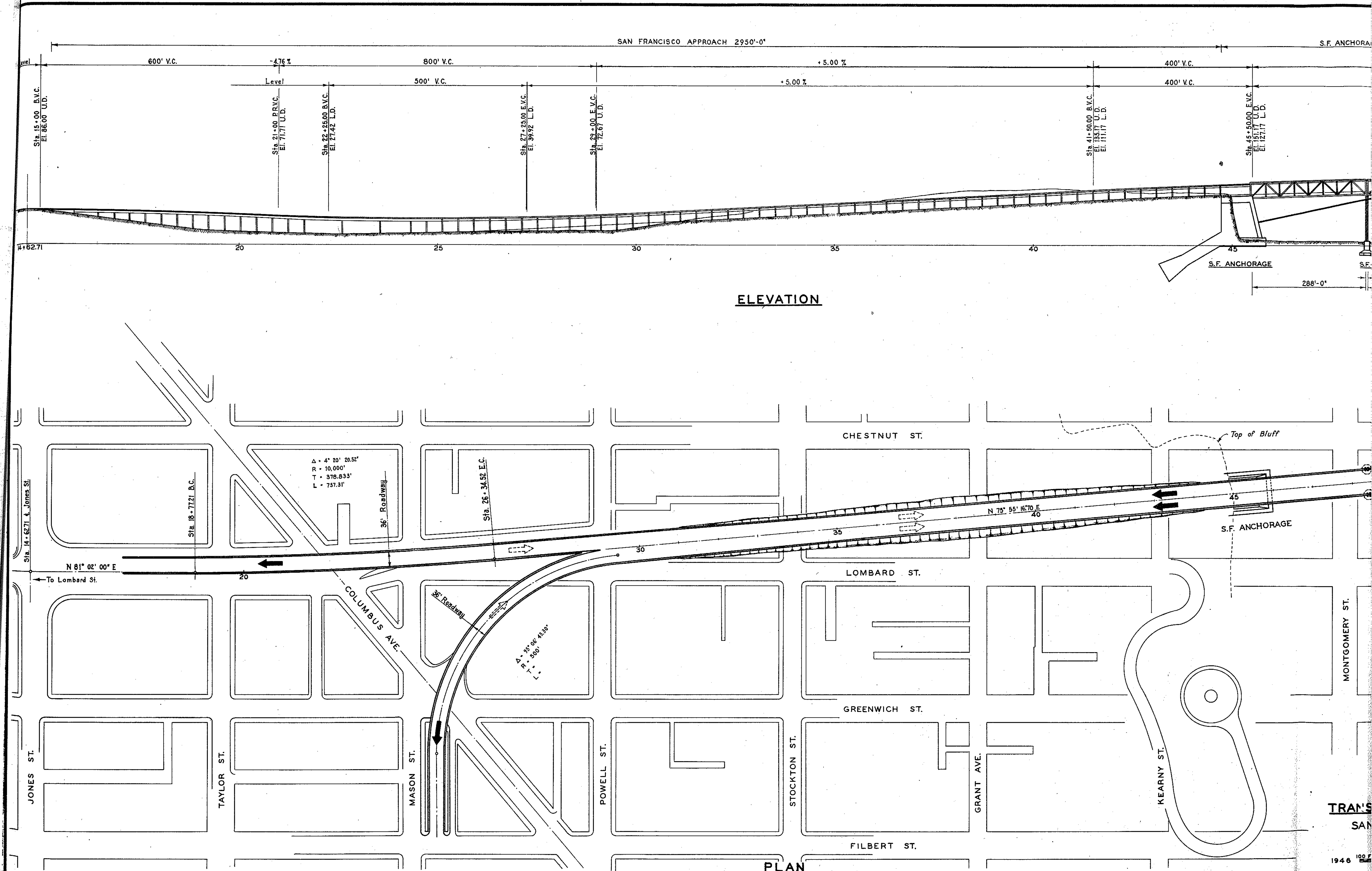
·PLAN·


3735'
YERBA BUENA ANCHORAGE
395'
UPPER ROADWAY CONCRETE VIADUCT
LOWER ROADWAY PAVEMENT 950'
PLATE GIRDER SPANS
2390'
800' V.C.
+4.0293 %
- 1.652 %
+ 0.2902 %
+4.75 %
Sta. 152+50 E.V.C.
El. 134.47 L.D.
Sta. 160+50 E.V.C.
El. 177.54 U.D.
Sta. 171+00 B.V.C.
El. 139.84 L.D.
Sta. 172+00 B.V.C.
El. 223.88 U.D.
Sta. 179+00 E.V.C.
El. 160.00 L.D.
Sta. 180+00 E.V.C.
El. 233.39 U.D.
22'-0"
288'
40' Spans
150'
195'
165'
Sta. 158+05 ℄ Pin
Sta. 181+90 ℄ Pier
ELEVATION
N 75°-55'-16.70 E.
SAN FRANCISCO-OAKLAND BAY BRIDGE
N 40° 20' 47.30" E
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-58

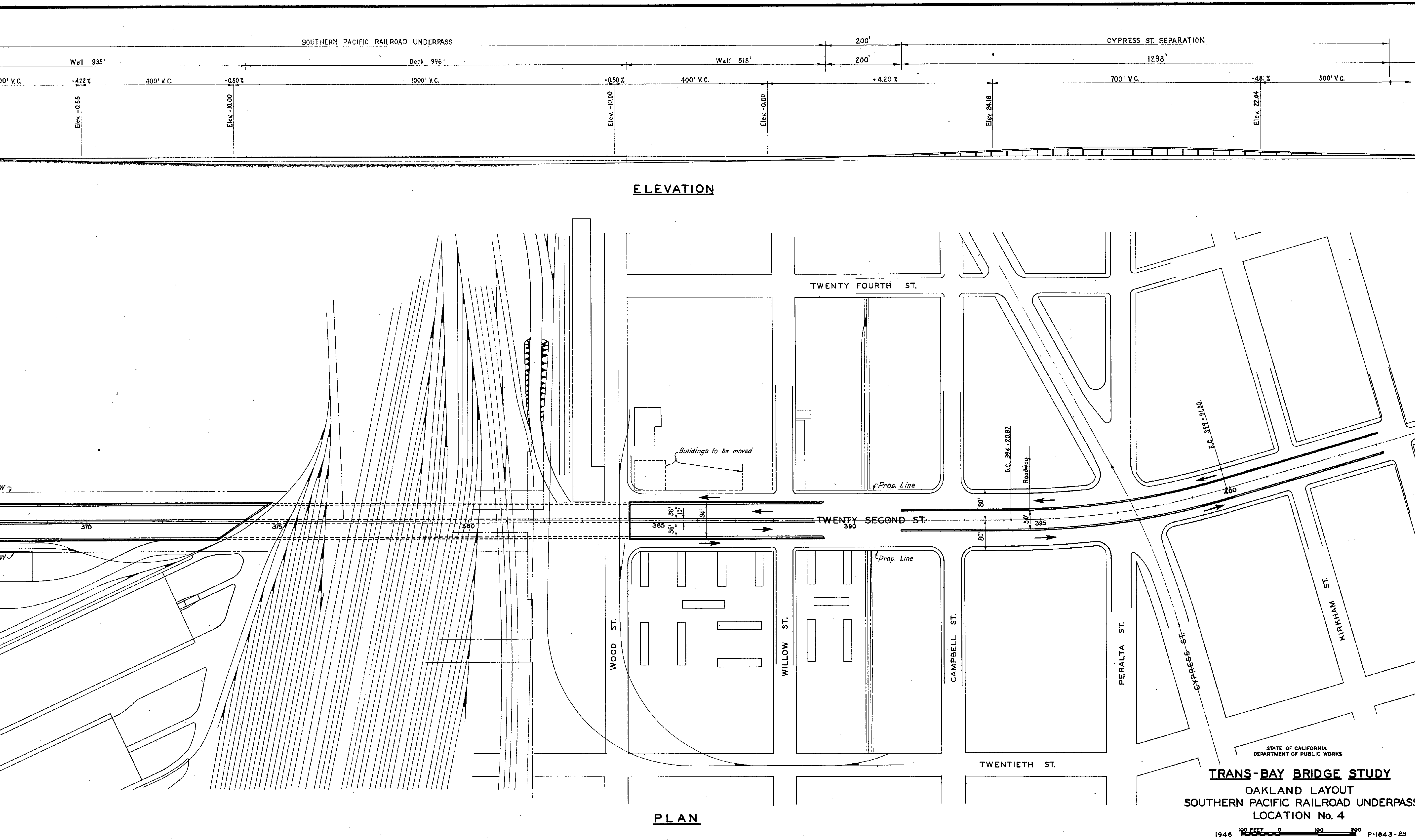

3735'
RBA BUENA ANCHORAGE
395'
UPPER ROADWAY CONCRETE VIADUCT
LOWER ROADWAY PAVEMENT 950'
PLATE GIRDER SPANS
2390'
+4.0293%
800'V.C.
- 1.652%
800'V.C.
+ 0.2902 %
800'V.C.
+4.75%
Sta.152+50 E.V.C.
El.134.47 L.D.
Sta.160+50 E.V.C.
El.177.54 U.D.
Sta.171+00 B.V.C.
El.139.84 L.D.
Sta.172+00 B.V.C.
El.223+88 U.D.
Sta.179+00 E.V.C.
El.160.00 L.D.
Sta.180+00 E.V.C.
El.233.39 U.D.
150'
160
170
288'
40' Spans
150'
195'
150'
195'
150'
195'
150'
195'
150'
195'
150'
195'
150'
165'
ELEVATION
Sta.158+05
℄ Pin
Sta.181+90
℄ Pier
150
160
N 75°-55'-16.70E
170
180
N 40°20'47.30" E
SAN FRANCISCO-OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-58

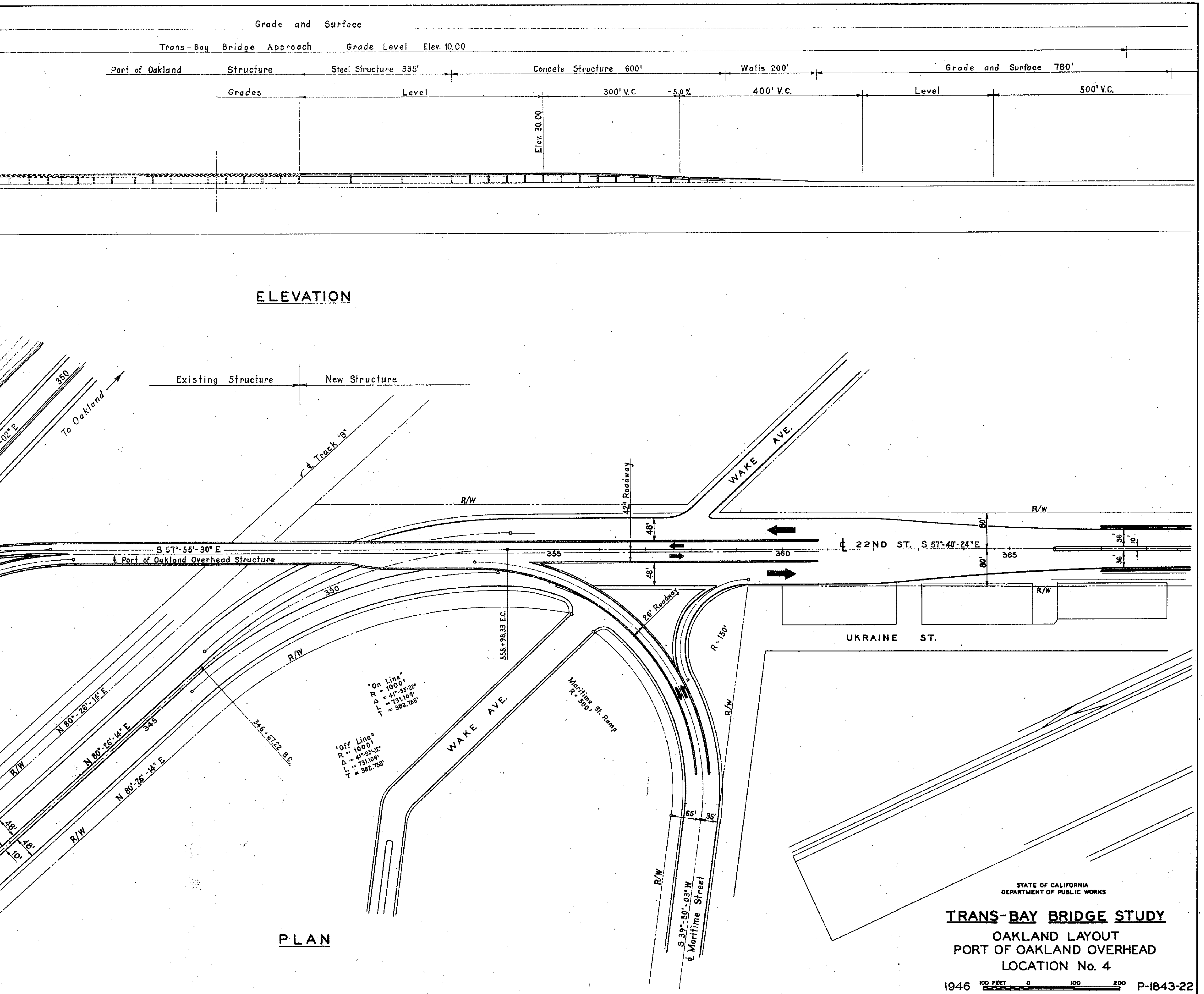

SAN FRANCISCO APPROACH 2950'-0"
S.F. ANCHORAGE 670'-0"
800' V.C.
+5.00 %
400' V.C.
+3.00 %
500' V.C.
+5.00 %
400' V.C.
+3.00 %
Sta. 27+25.00 E.V.C.
El. 39.92 L.D.
Sta. 29+00 E.V.C.
El. 72.67 U.D.
Sta. 41+50.00 B.V.C.
El. 135.17 U.D.
El. 111.17 L.D.
Sta. 45+50.00 E.V.C.
El. 151.17 U.D.
El. 127.17 L.D.
25
30
35
40
45
50
S.F. ANCHORAGE
S.F.-1
W-1
288'-0"
6'-0"
288'-0"
22'-0"
1550'-0"
Sta. 51+54.74
℄ Pin
ELEVATION
CHESTNUT ST.
Top of Bluff
60' Roadway
36' Roadway
Sta. 26+34.52 E.C.
N 75° 55' 16.70 E
S.F. ANCHORAGE
W-1
LOMBARD ST.
36' Roadway
Δ = 95° 06' 43.36"
R = 500'
T =
L =
MBUS AVE.
MONTGOMERY ST.
SANSOME ST.
GREENWICH ST.
MASON ST.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
FILBERT ST.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-39


YERBA BUENA ANCHORAGE
395'
-3.0%
-3.0%
800' V.C.
Sta. 144+50 B.V.C.
El. 169.31 U.D.
El. 145.31 L.D.
W-5
150'
1550'
22'-0"
288'
Sta. 144+54.74
℄ Pin
150
200
150
100
50
10



SAN FRANCISCO APPROACH 2950'-0"
S.F. ANCHORA
Level
600' V.C.
-4.76 %
800' V.C.
+5.00 %
400' V.C.
Level
500' V.C.
+5.00 %
400' V.C.
Sta. 15+00 B.V.C.
El. 86.00 U.D.
Sta. 21+00 P.R.V.C.
El. 71.71 U.D.
Sta. 22+25.00 B.V.C.
El. 27.42 L.D.
Sta. 27+25.00 E.V.C.
El. 39.92 L.D.
Sta. 29+00 E.V.C.
El. 72.67 U.D.
Sta. 41+50.00 B.V.C.
El. 135.17 U.D.
El. 111.17 L.D.
Sta. 45+50.00 E.V.C.
El. 151.17 U.D.
El. 127.17 L.D.
14+62.71
20
25
30
35
40
45
S.F. ANCHORAGE
288'-0"
ELEVATION
CHESTNUT ST.
Top of Bluff
Δ = 4° 20' 20.52"
R = 10,000'
T = 378.833'
L = 757.31'
36' Roadway
Sta. 26+34.52 E.C.
Sta. 18+77.21 B.C.
Sta. 14+62.71 ℄ Jones St.
N 81° 02' 00" E
To Lombard St.
20
30
35
40
45
N 75° 55' 16.70 E
S.F. ANCHORAGE
LOMBARD ST.
COLUMBUS AVE.
36' Roadway
Δ = 95° 00' 43.30"
R = 500'
T =
L =
MONTGOMERY ST.
GREENWICH ST.
JONES ST.
TAYLOR ST.
MASON ST.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
FILBERT ST.
PLAN
TRANS
SAN
1946


SOUTHERN PACIFIC RAILROAD UNDERPASS
CYPRESS ST. SEPARATION
Wall 935'
Deck 996'
Wall 518'
200'
200'
1298'
400' V.C.
1000' V.C.
400' V.C.
700' V.C.
500' V.C.
-4.22 %
-0.50 %
+0.50 %
+4.20 %
-4.81 %
Elev. -0.55
Elev. -10.00
Elev. -10.00
Elev. -0.60
Elev. 24.18
Elev. 22.04
ELEVATION
TWENTY FOURTH ST.
TWENTY SECOND ST.
TWENTIETH ST.
WOOD ST.
WILLOW ST.
CAMPBELL ST.
PERALTA ST.
CYPRESS ST.
KIRKHAM ST.
Buildings to be moved
Prop. Line
Prop. Line
B.C. 394 + 20.87
E.C. 399 + 91.30
Roadway
370
375
380
385
390
395
400
36'
10'
36'
94'
80'
80'
50'
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
OAKLAND LAYOUT
SOUTHERN PACIFIC RAILROAD UNDERPASS
LOCATION No. 4
1946
100 FEET 0 100 200
P-1843-23

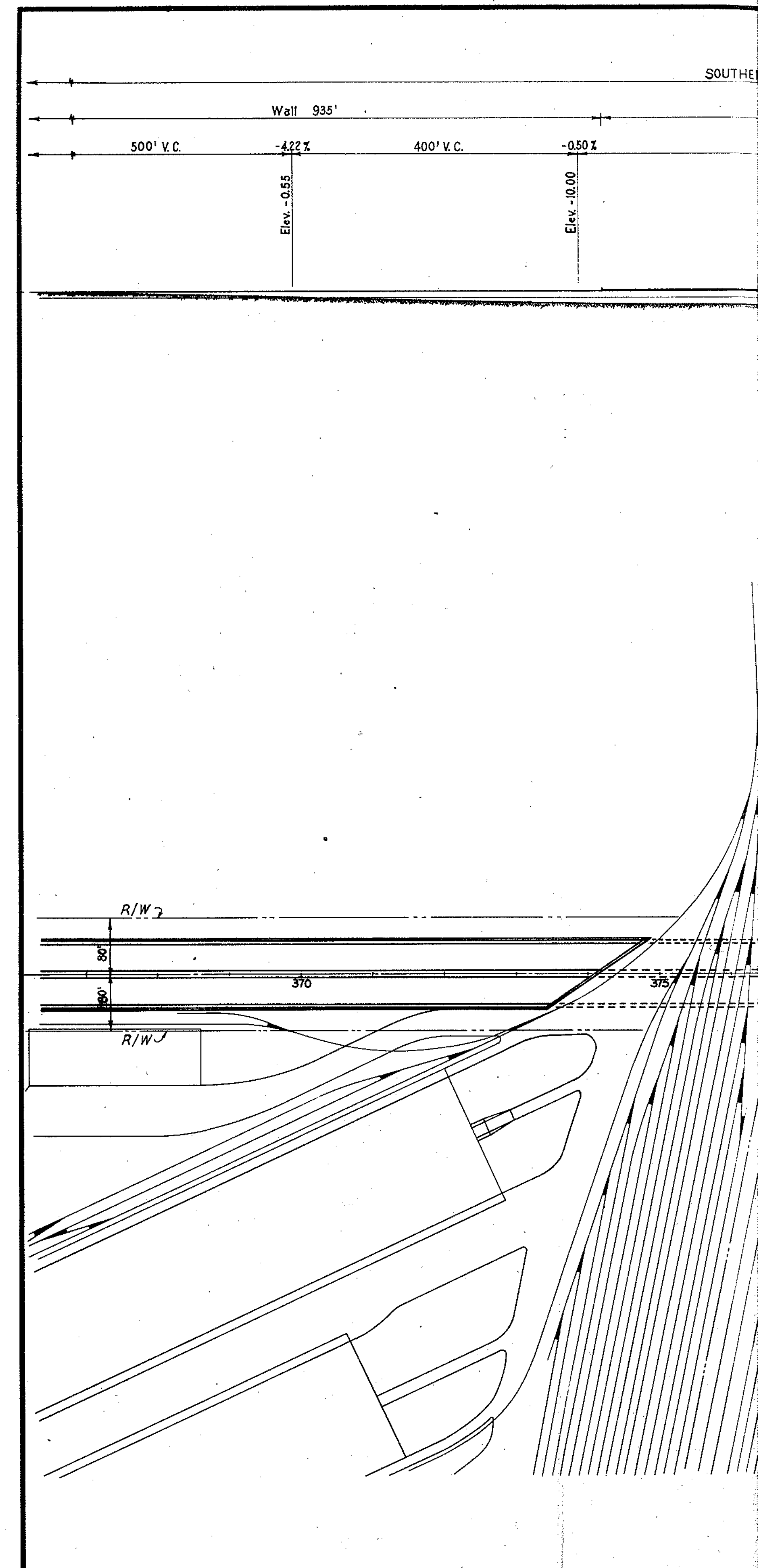


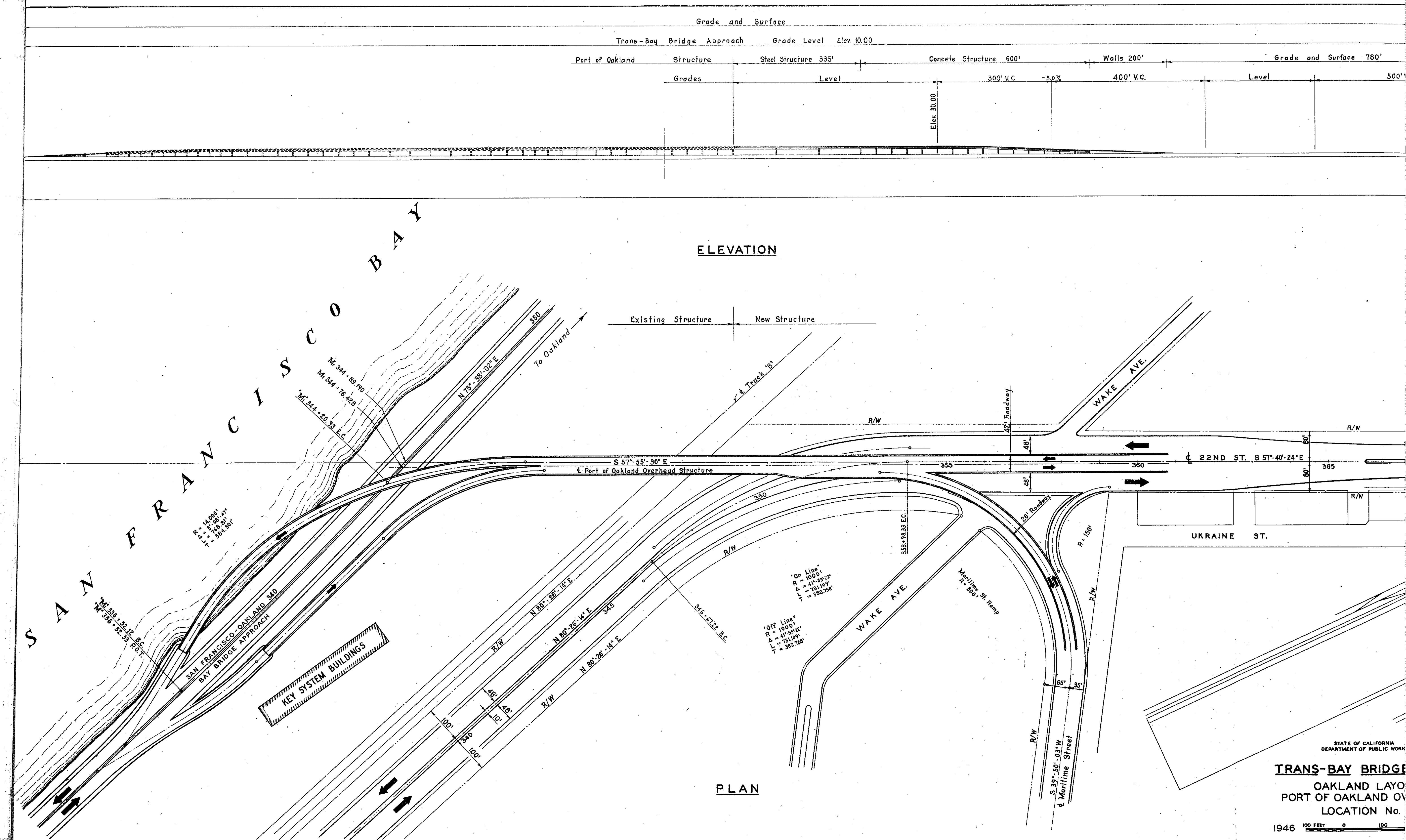
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

TRANS-BAY BRIDGE STUDY

OAKLAND LAYOUT
PORT OF OAKLAND OVERHEAD
LOCATION No. 4

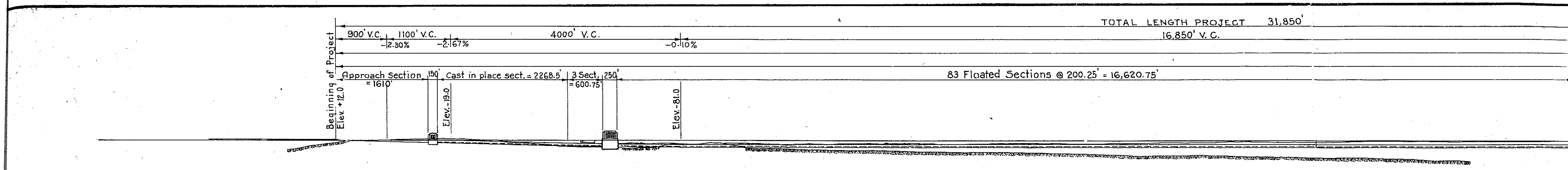
1946 100 FEET 0 100 200 P-1843-22



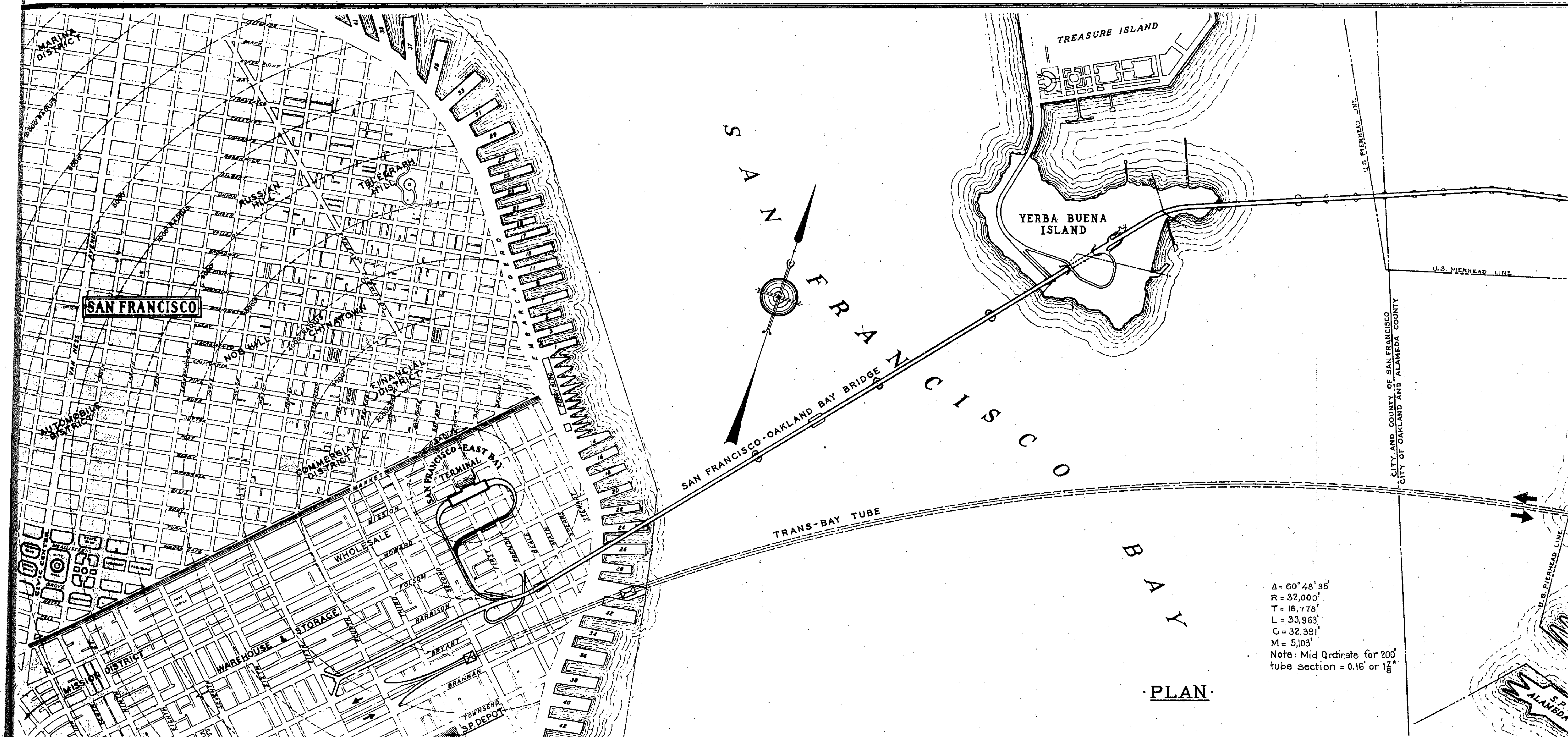


Grade and Surface
Trans-Bay Bridge Approach Grade Level Elev. 10.00
Port of Oakland Structure
Steel Structure 335'
Concete Structure 600'
Walls 200'
Grade and Surface 780'
Grades
Level
300' V.C
-5.0%
400' V.C.
Level
Elev. 30.00
ELEVATION
SAN FRANCISCO BAY
Existing Structure
New Structure
To Oakland
℄ Track 'B'
WAKE AVE.
42' Roadway
R/W
S 57°-55'-30" E
℄ Port of Oakland Overhead Structure
℄ 22ND ST. S 57°-40'-24" E
355
360
365
350
26' Roadway
UKRAINE ST.
R = 150'
N 75°-38'-02" E
M. 344 + 89.190
M. 344 + 76.428
"M" 344 + 20.93 E.C.
353 + 98.33 E.C.
346 + 67.22 B.C.
"On Line"
R = 1000'
Δ = 41°-53'-22"
L = 731.109'
T = 382.758'
"Off Line"
R = 1000'
Δ = 41°-53'-22"
L = 731.109'
T = 382.758'
Maritime St. Ramp
R = 300'
WAKE AVE.
N 80°-26'-14" E.
N 80°-26'-14" E
N 80°-26'-14" E
345
340
SAN FRANCISCO-OAKLAND BAY BRIDGE APPROACH
KEY SYSTEM BUILDINGS
"M" 336 + 52.12 B.C.
"M" 336 + 32.33 P.O.T.
48'
48'
10'
100'
100'
65'
35'
S 39°-50'-03" W
℄ Maritime Street
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORK
TRANS-BAY BRIDGE
OAKLAND LAYO
PORT OF OAKLAND OV
LOCATION No.
1946
100 FEET 0 100

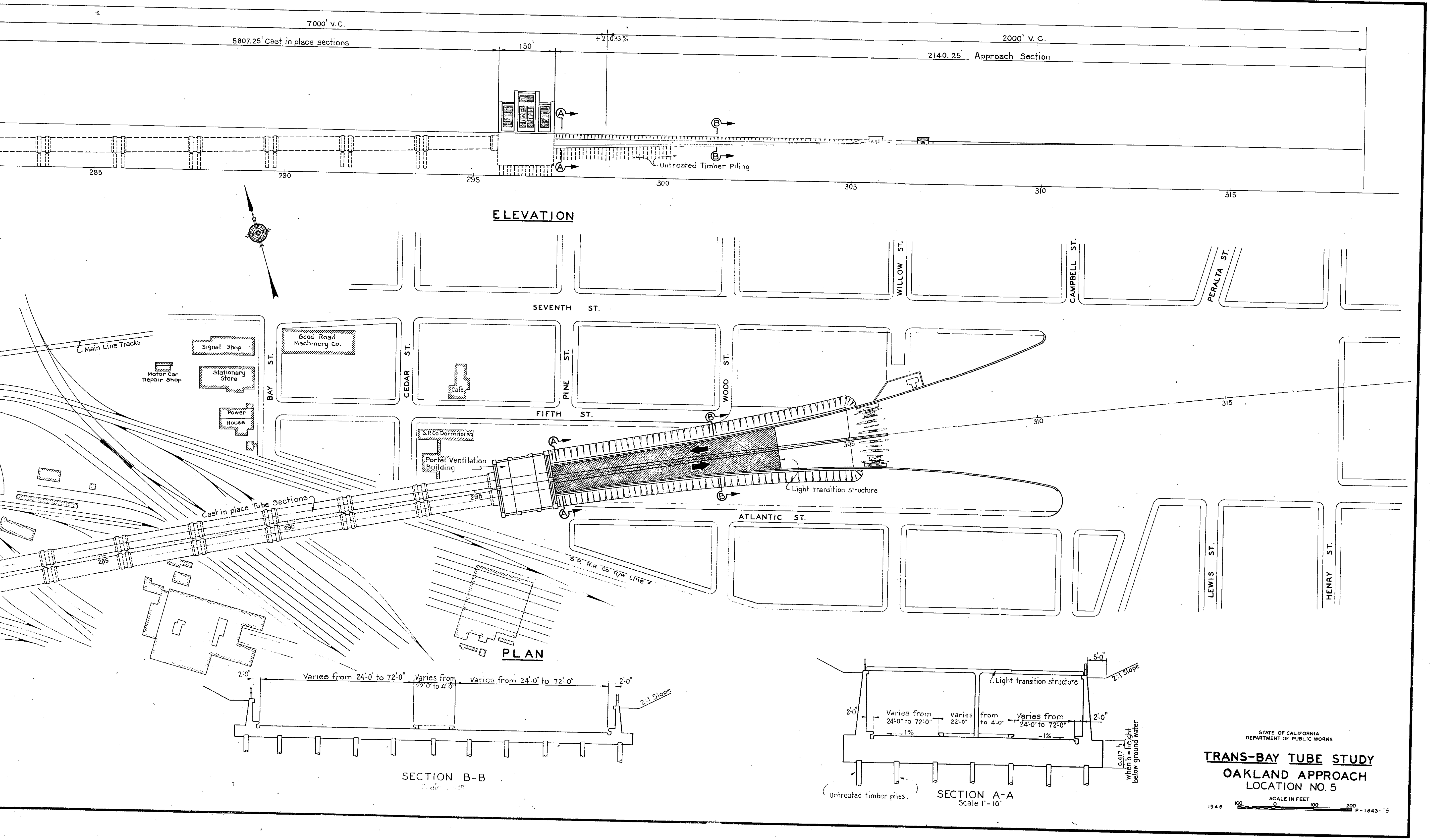

TOTAL LENGTH PROJECT 31,850'
16,850' V. C.
7000' V.C.
2000' V.C.
+0.10%
+2.033 %
loated Sections @ 200.25' = 16,620.75'
250' 10 Floated Spans@ 2000.25'
Cast in place section = 5658'
150' Approach Section = 2289.5'
Elev.-81.0
Elev.-6.45
Elev.+14.0
End of Project
·ELEVATION·
SECTION
BAY CROSSING
45'-0"
16'-6"
16'-6"
BERKELEY
EMERYVILLE
OAKLAND
TREASURE ISLAND
YERBA BUENA ISLAND
OUTER HARBOR
INNER HARBOR
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
PORT OF OAKLAND OVERHEAD
EAST BAY YARD
DISTRIBUTION STRUCTURE
SAN PABLO UNDERPASS
FOLGER UNDER PASS
EAST SHORE HIGHWAY
ASHBY AVENUE
STANFORD AVENUE
PARK AVENUE
YERBA BUENA
CITY OF OAKLAND CHARTER LINE
16TH ST. STATION
WESTERN PACIFIC PIER
S.P. CO. ALAMEDA PIER
OUTER HARBOR TERMINAL
BAY
Δ = 60° 48' 35"
R = 32,000'
T = 18,778'
L = 33,963'
C = 32,391'
M = 5,103'
Note: Mid Ordinate for 200' tube section = 0.16' or 1 7/8"
·PLAN·
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY TUBE STUDY
GENERAL PLAN
LOCATION NO. 5
SCALE IN FEET
0 1000 2500
1946
P-1843-

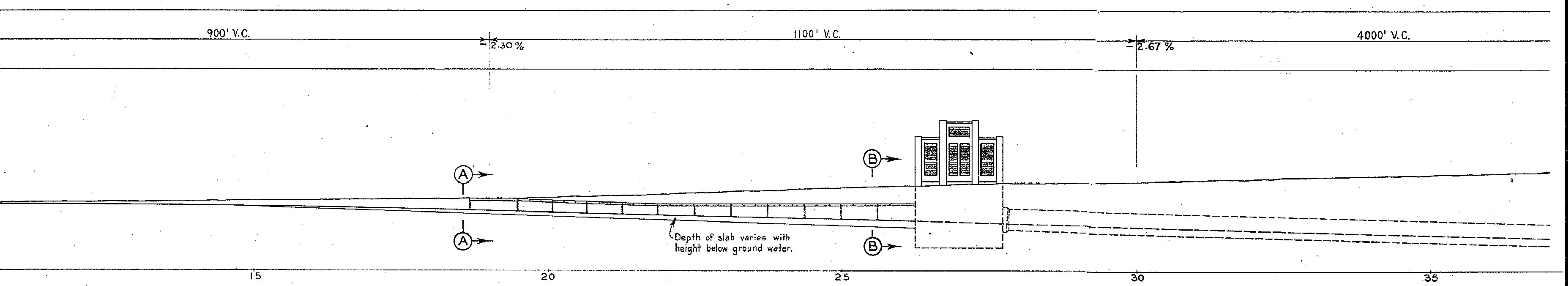


·ELEVATION·

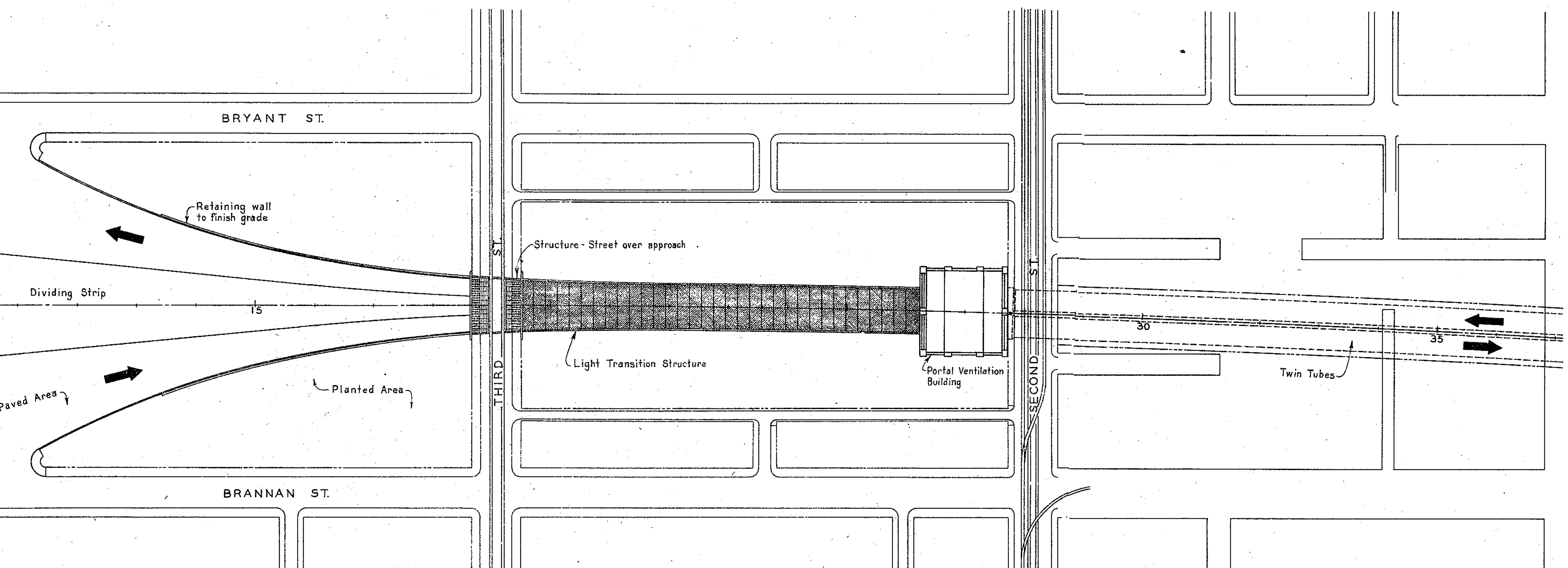


·PLAN·

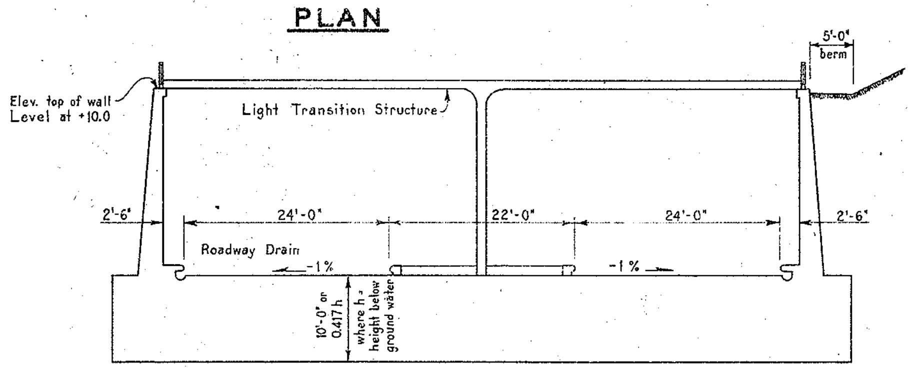

7000' V.C.
5807.25' Cast in place sections
150'
+2.033%
2000' V.C.
2140.25' Approach Section
Untreated Timber Piling
285
290
295
300
305
310
315
ELEVATION
Main Line Tracks
Signal Shop
Motor Car Repair Shop
Stationary Store
Power House
Good Road Machinery Co.
Cafe
S.P. Co. Dormitories
Portal Ventilation Building
SEVENTH ST.
FIFTH ST.
ATLANTIC ST.
BAY ST.
CEDAR ST.
PINE ST.
WOOD ST.
WILLOW ST.
CAMPBELL ST.
PERALTA ST.
LEWIS ST.
HENRY ST.
Cast in place Tube Sections
Light transition structure
S.P. R.R. Co. R/W Line
PLAN
2'-0"
Varies from 24'-0" to 72'-0"
Varies from 22'-0" to 4'-0"
Varies from 24'-0" to 72'-0"
2'-0"
2:1 Slope
SECTION B-B
5'-0"
2:1 Slope
Light transition structure
Varies from 24'-0" to 72'-0"
Varies 22'-0"
from to 4'-0"
Varies from 24'-0" to 72'-0"
-1%
-1%
0.417 h
when h = height below ground water
Untreated timber piles
SECTION A-A
Scale 1" = 10'
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY TUBE STUDY
OAKLAND APPROACH
LOCATION NO. 5
SCALE IN FEET
100 0 100 200
1946
P-1843-6



ELEVATION



PLAN



SECTION B-B

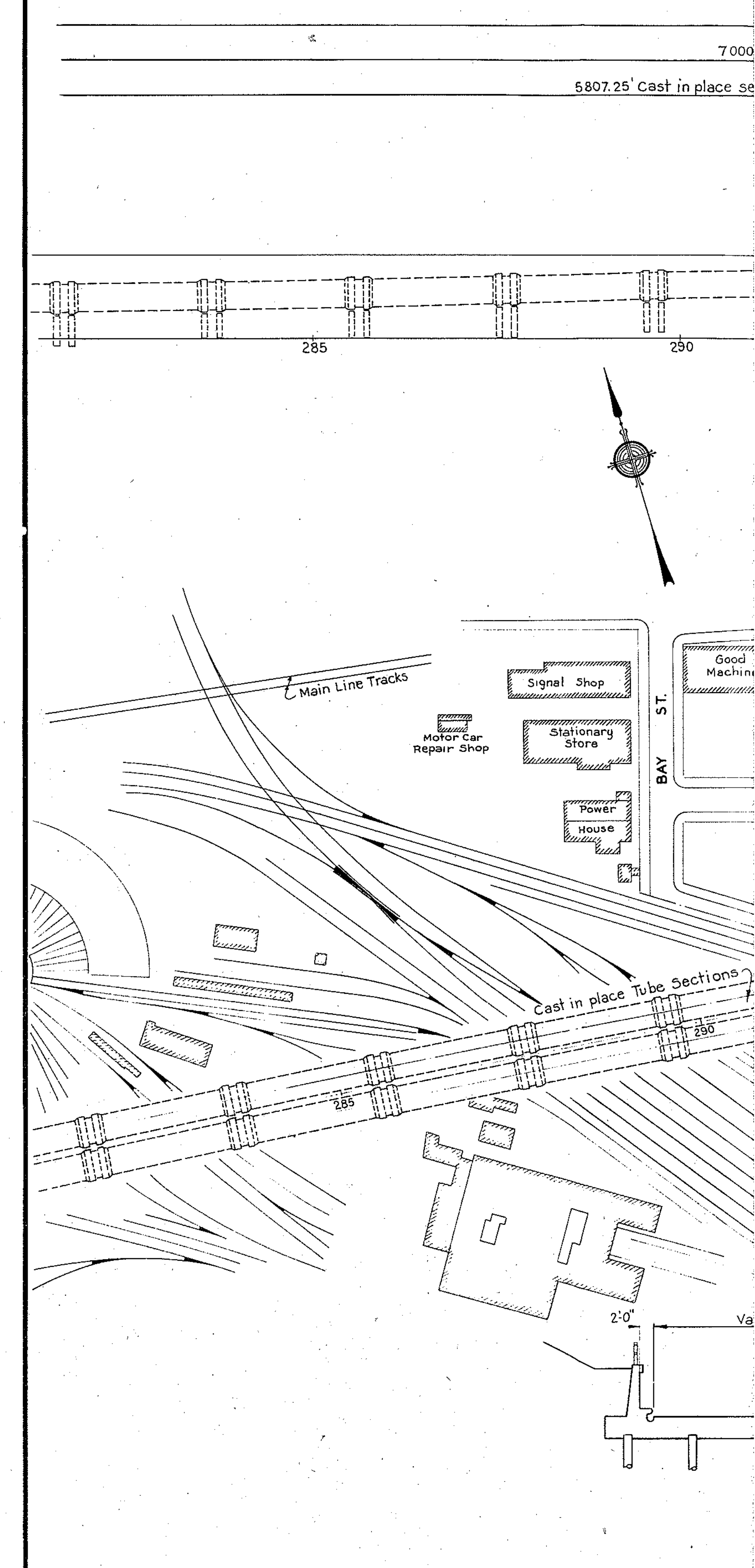
Scale 1" = 10'

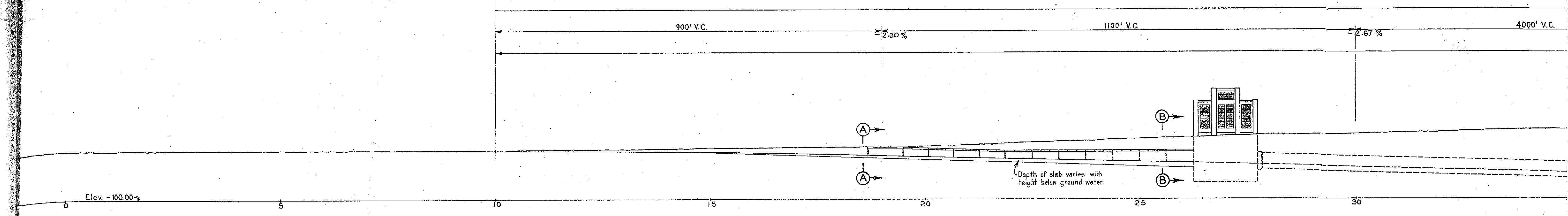
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

TRANS-BAY TUBE STUDY

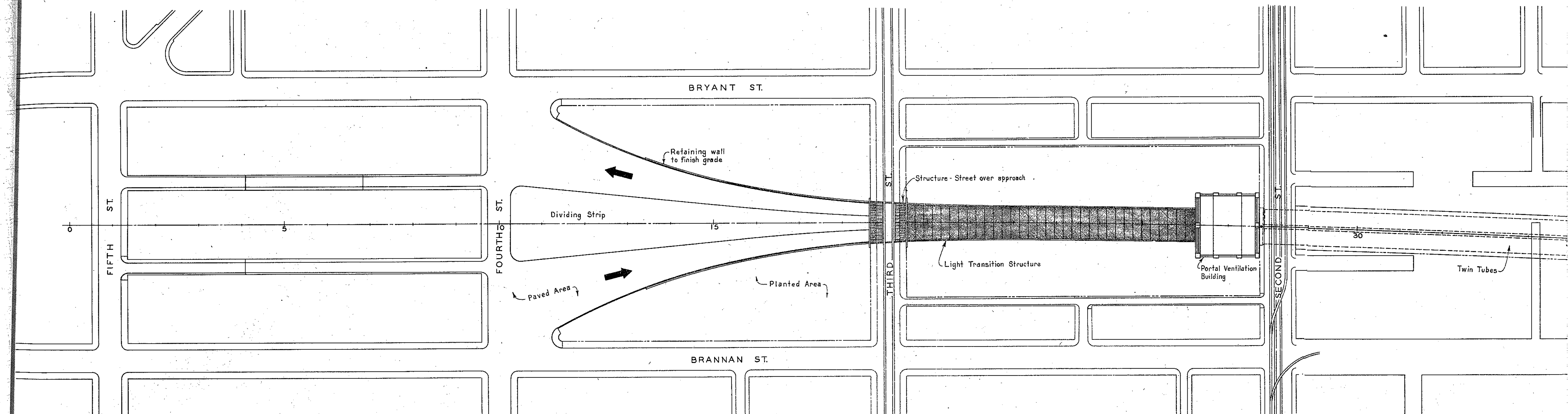
SAN FRANCISCO APPROACH
LOCATION No. 5

1946 100 FEET 0 100 200 P-1843-

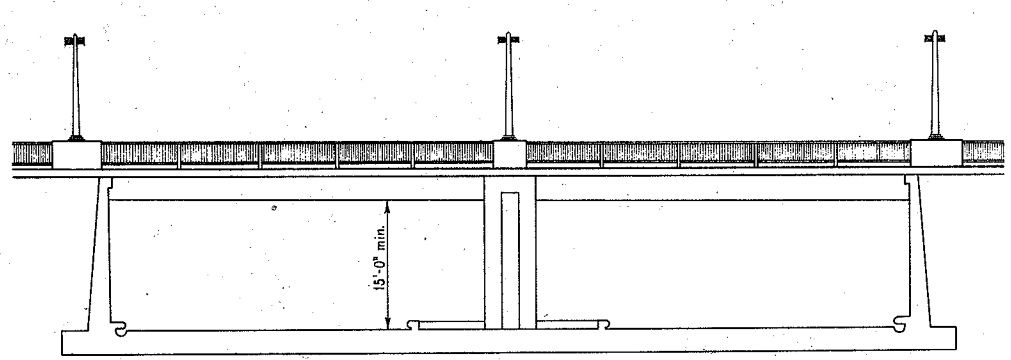




ELEVATION

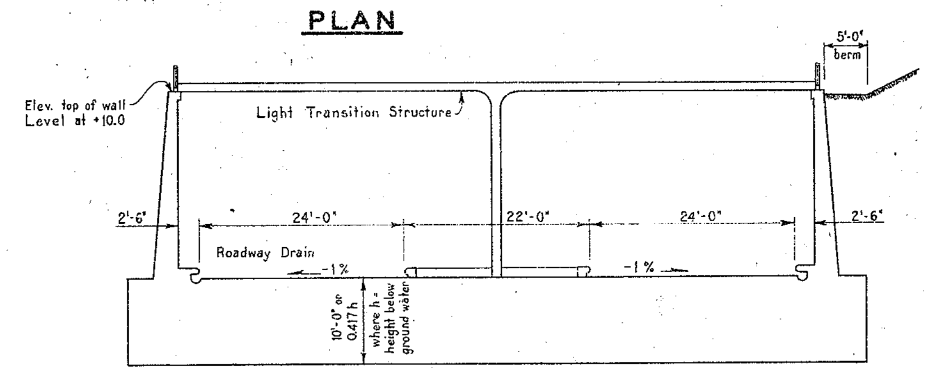


PLAN



SECTION A-A

Scale 1" = 10'



SECTION B-B

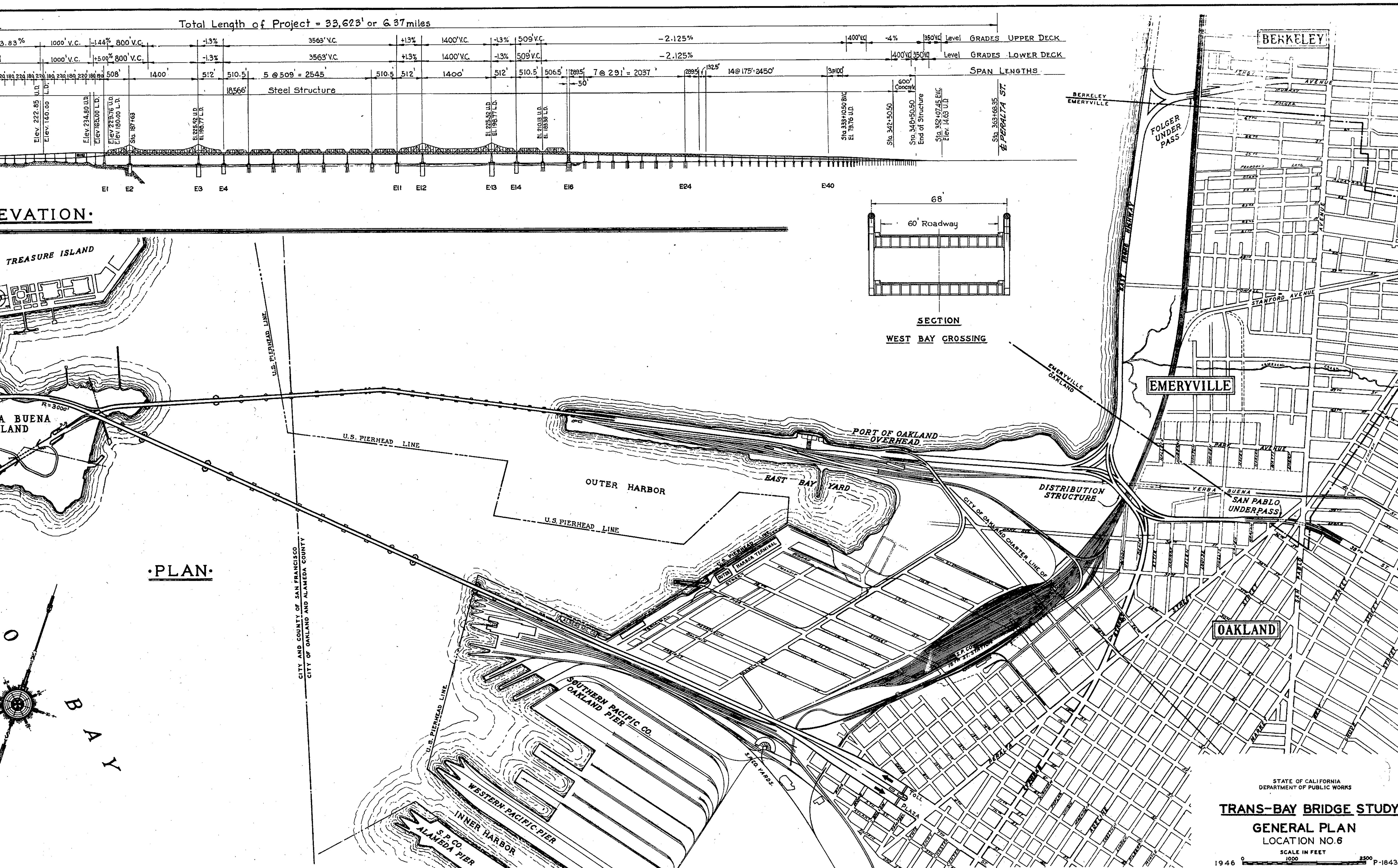
Scale 1" = 10'

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WO

TRANS-BAY TUBE

SAN FRANCISCO AP
LOCATION No.

1946 100 FEET 0 100



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

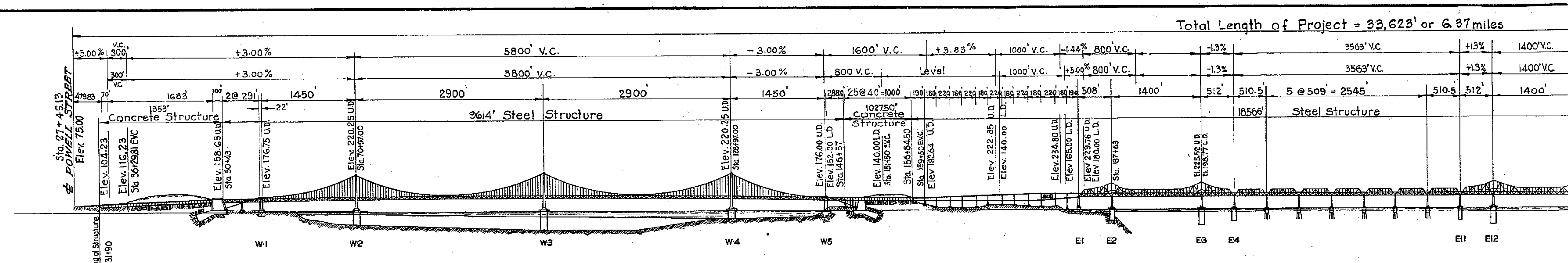
TRANS-BAY BRIDGE STUDY

GENERAL PLAN

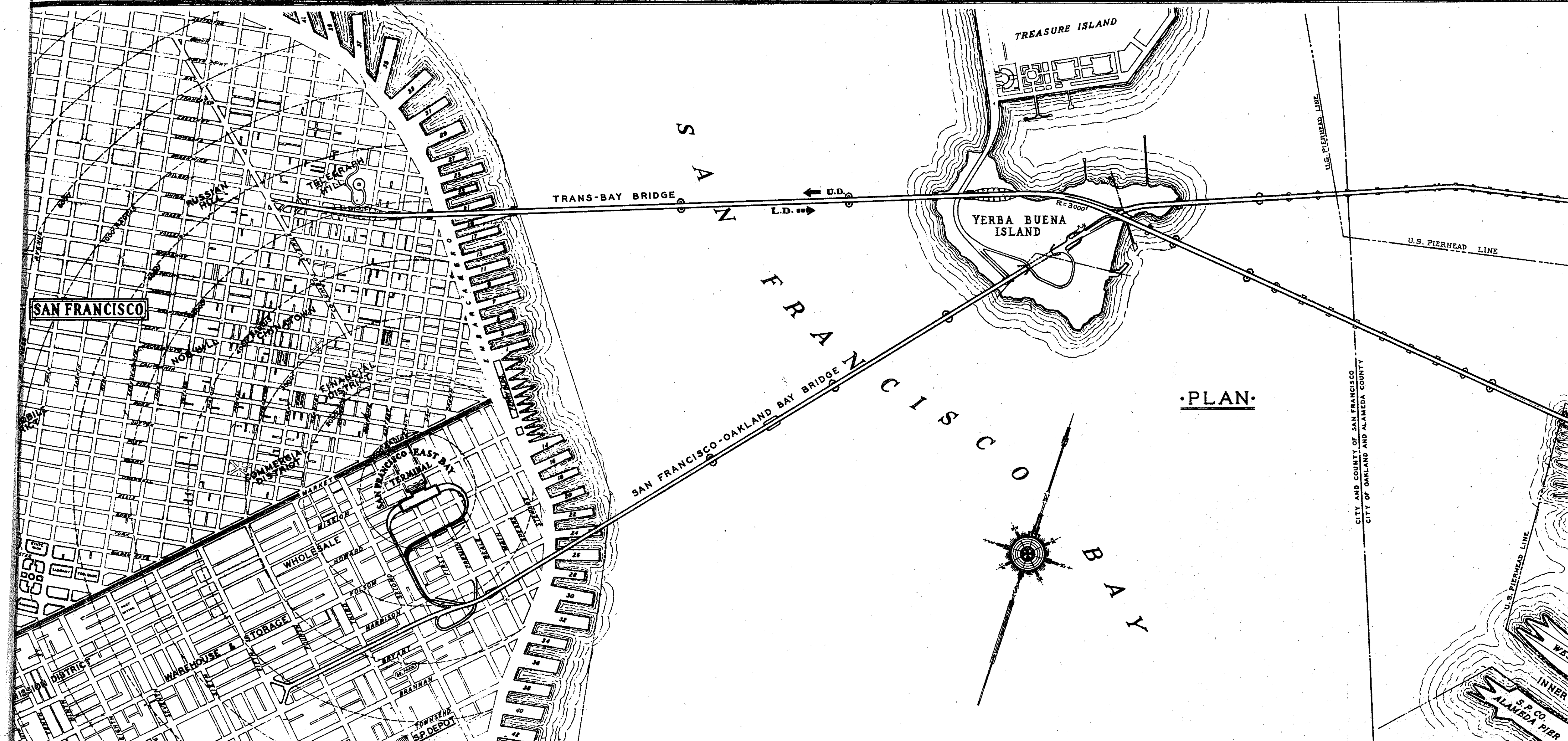
LOCATION NO. 6

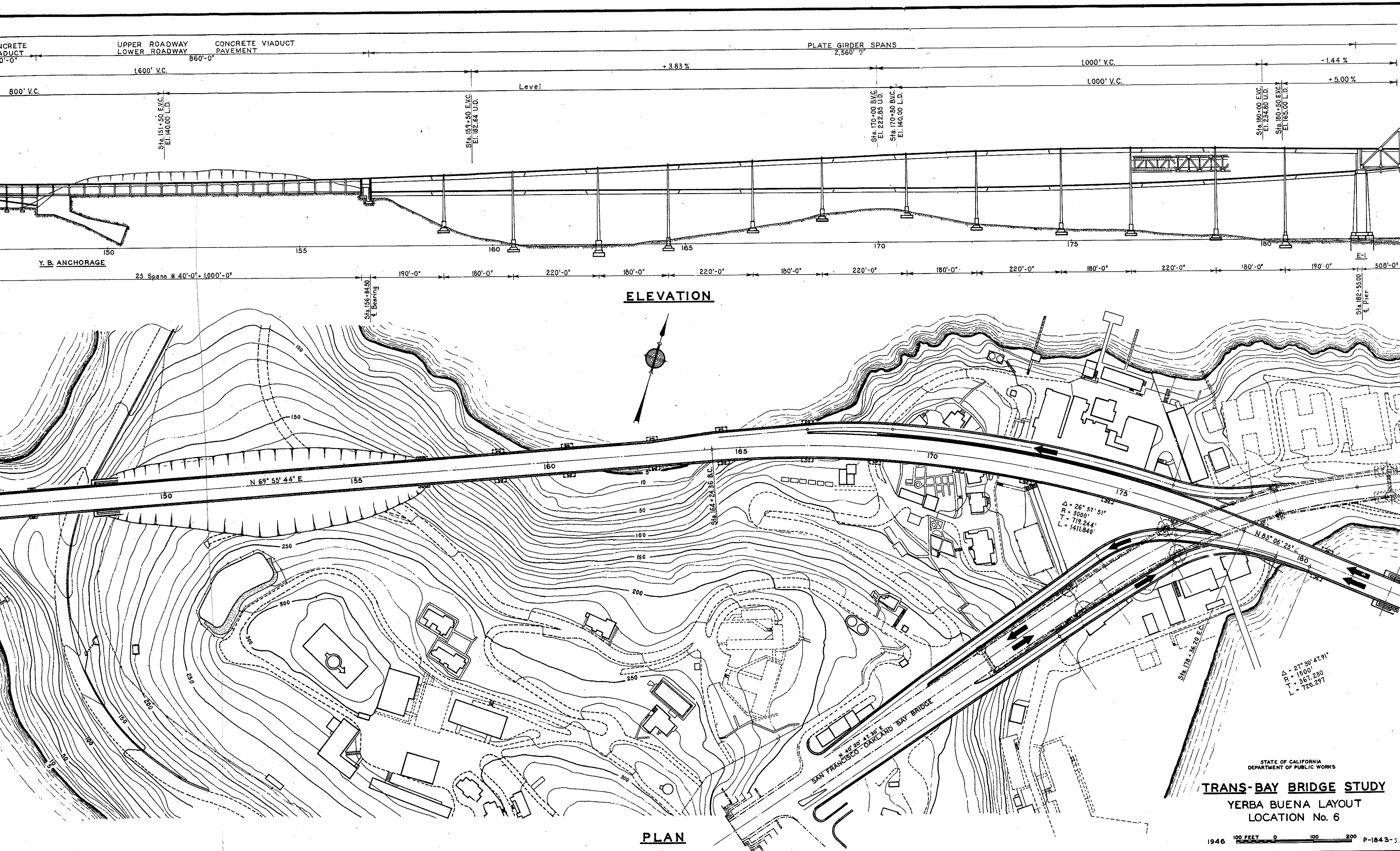
SCALE IN FEET

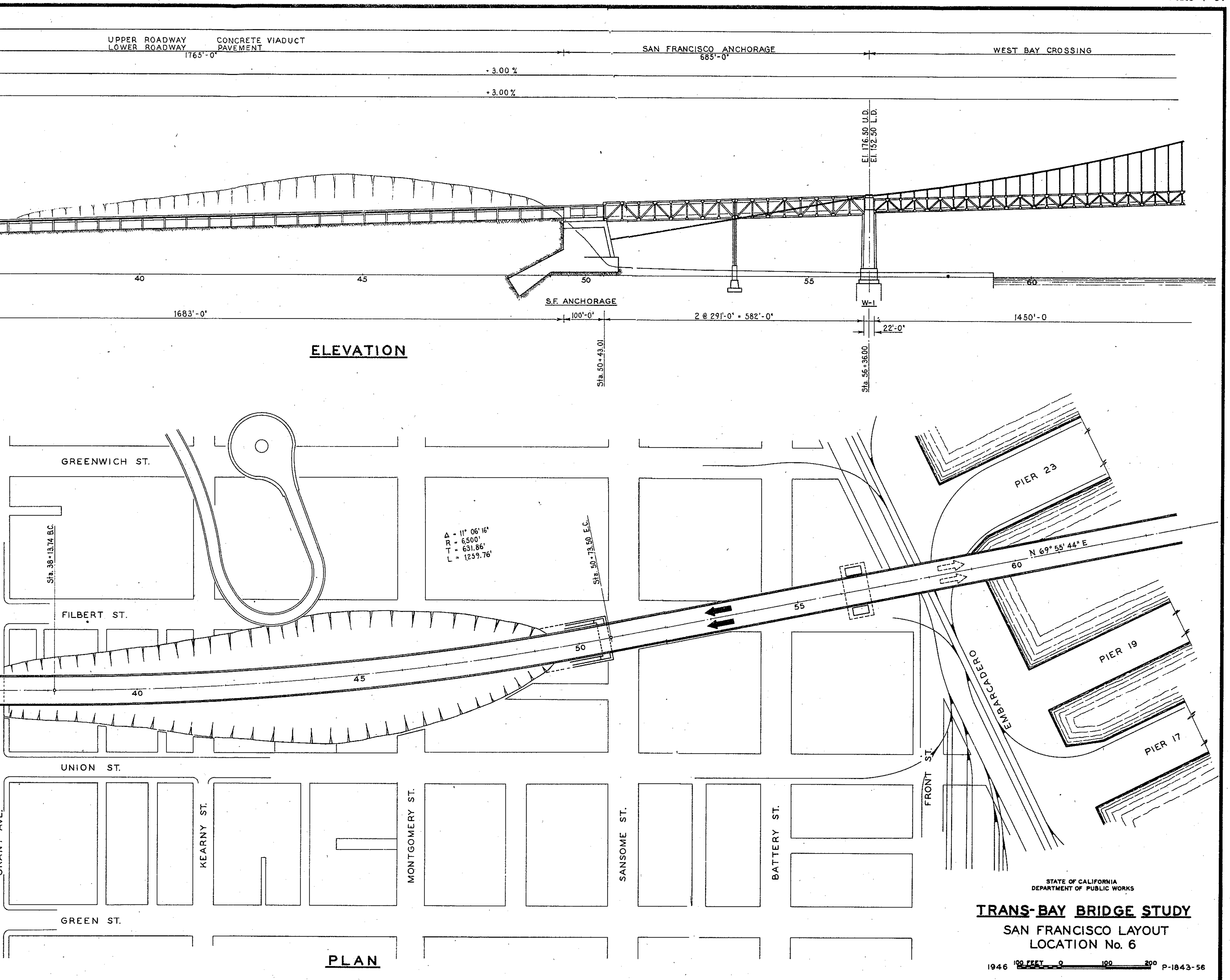
1946 0 1000 2500 P-1843-

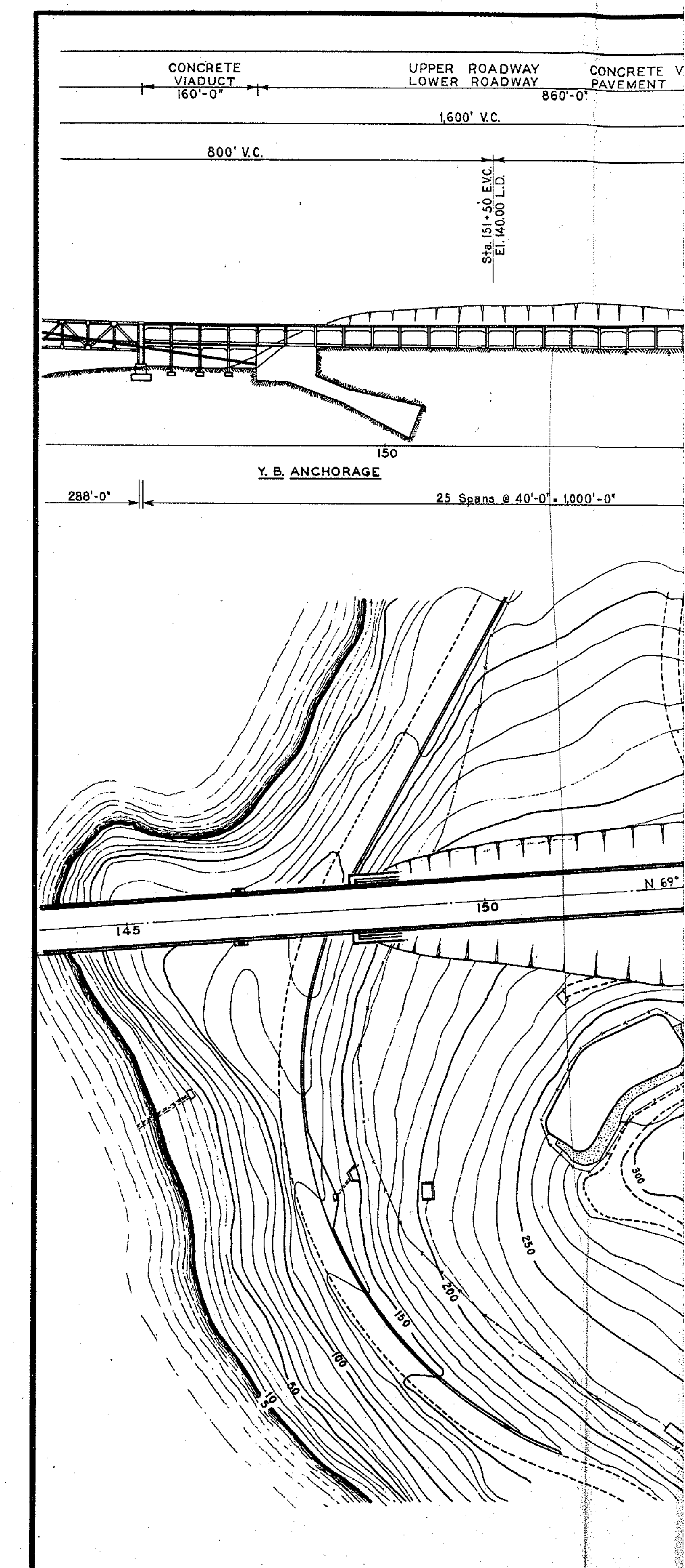

Total Length of Project = 33,623' or 6.37 miles
5800' V.C.
+3.00%
9614' Steel Structure
Concrete Structure
18566' Steel Structure
5 @ 509' = 2545'
Beginning of Structure
Sta. 31+90
Sta. 27+45.13
℄ POWELL STREET
Elev. 75.00
W-1
W-2
W-3
W-4
W-5
E-1
E-2
E-3
E-4
E-11
E-12

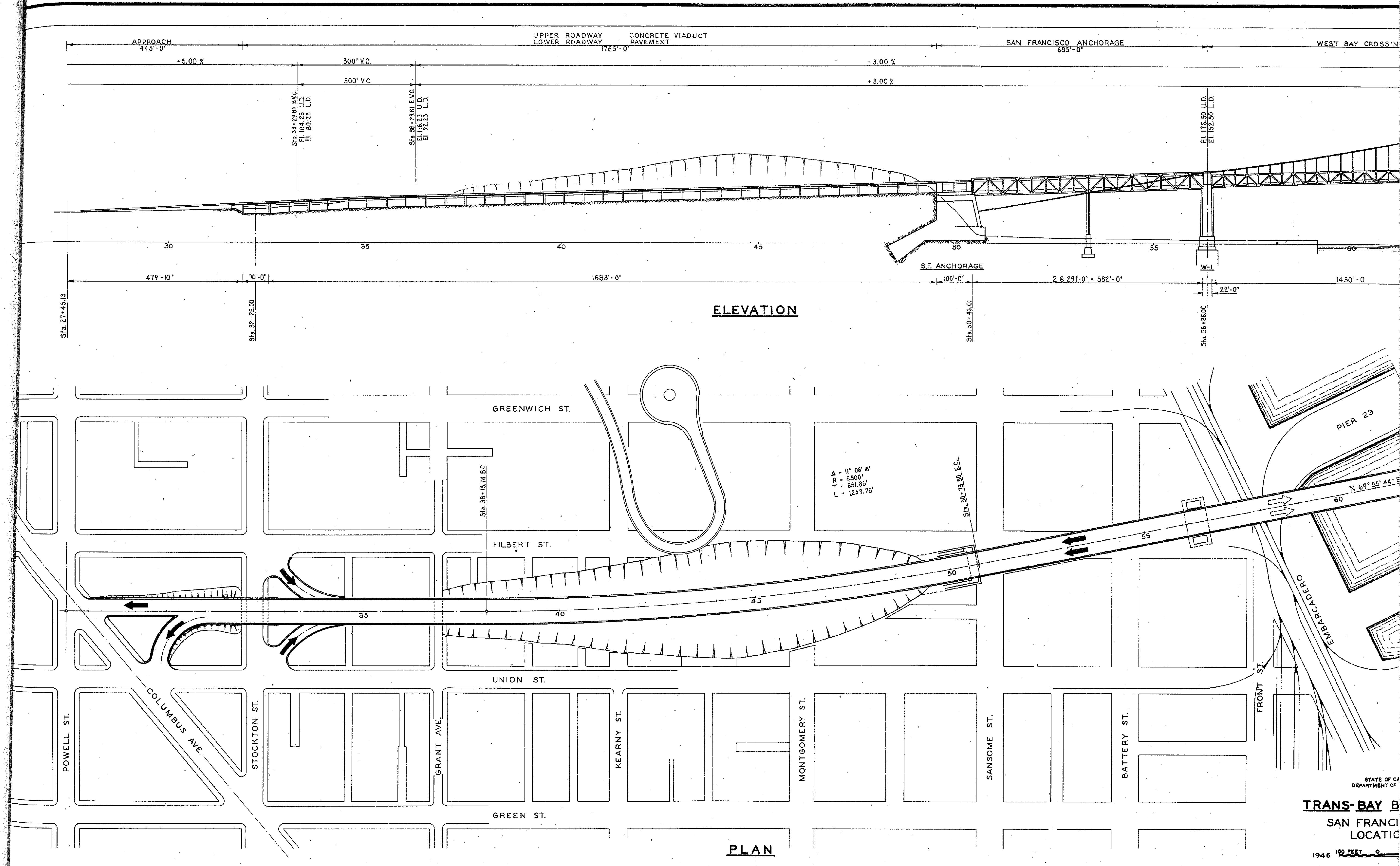
·ELEVATION·

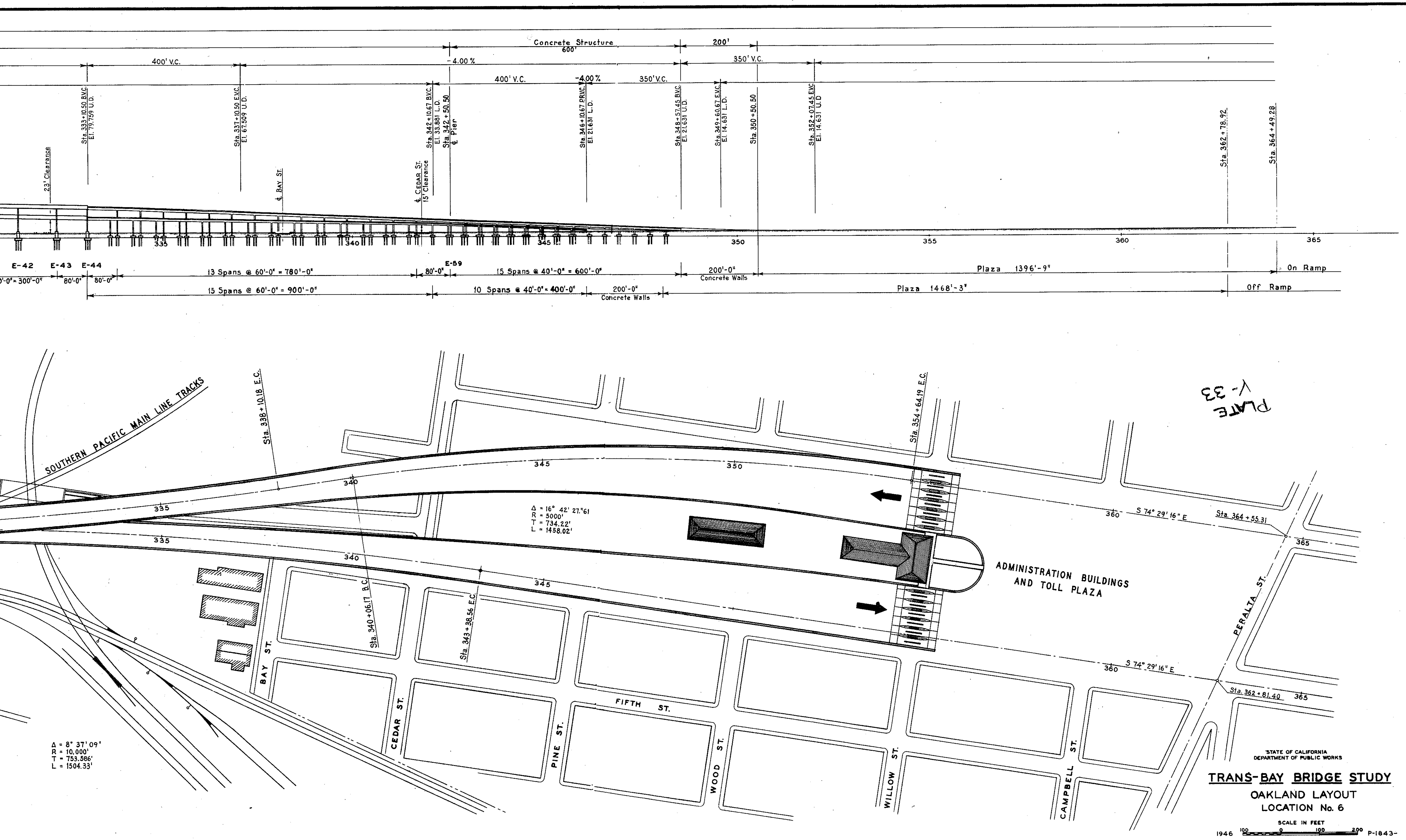

SAN FRANCISCO
SAN FRANCISCO BAY
TRANS-BAY BRIDGE
SAN FRANCISCO-OAKLAND BAY BRIDGE
U.D.
L.D.
TREASURE ISLAND
YERBA BUENA ISLAND
R=3000'
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
RUSSIAN HILL
TELEGRAPH HILL
NOB HILL
CHINATOWN
FINANCIAL DISTRICT
COMMERCIAL DISTRICT
SAN FRANCISCO-EAST BAY TERMINAL
WHOLESALE
WAREHOUSE & STORAGE
MISSION DISTRICT
MARKET
S.P. DEPOT
INNER HA
S.P. CO. ALAMEDA PIER
·PLAN·

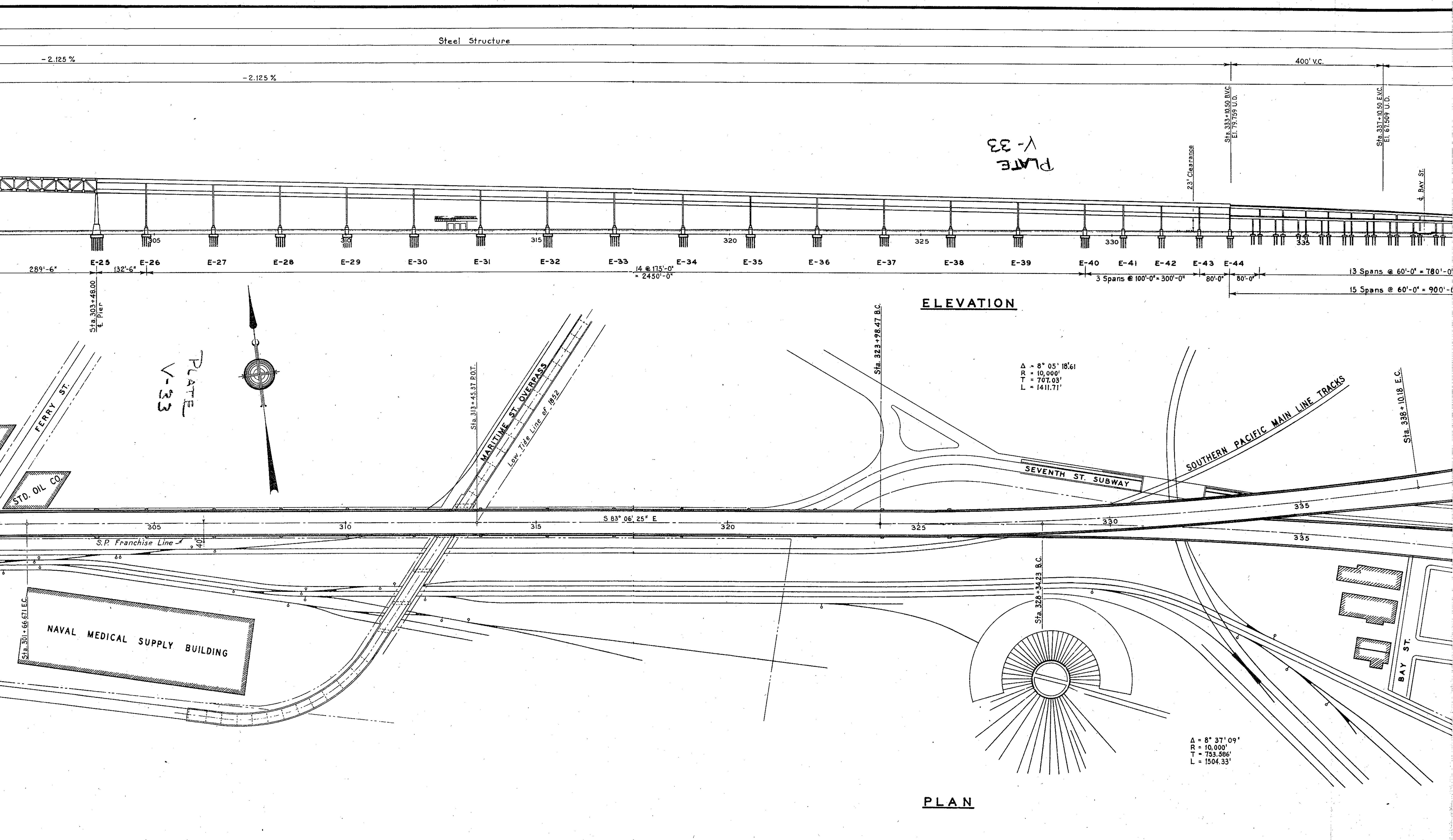

UPPER ROADWAY
LOWER ROADWAY
CONCRETE VIADUCT
PAVEMENT
860'-0"
PLATE GIRDER SPANS
2,560'-0"
1,600' V.C.
+ 3.83 %
1,000' V.C.
- 1.44 %
800' V.C.
Level
1,000' V.C.
+ 5.00 %
Sta. 151 + 50 E.V.C.
El. 140.00 L.D.
Sta. 159 + 50 E.V.C.
El. 182.64 U.D.
Sta. 170 + 00 B.V.C.
El. 222.85 U.D.
Sta. 170 + 50 B.V.C.
El. 140.00 L.D.
Sta. 180 + 00 E.V.C.
El. 234.80 U.D.
Sta. 180 + 50 E.V.C.
El. 165.00 L.D.
Y. B. ANCHORAGE
25 Spans @ 40'-0" = 1,000'-0"
Sta. 156 + 84.50
℄ Bearing
190'-0"
180'-0"
220'-0"
508'-0"
E-1
Sta. 182 + 55.00
℄ Pier
ELEVATION
N 69° 55' 44" E
Sta. 164 + 24.36 B.C.
Δ = 26° 57' 51"
R = 3000'
T = 719.244'
L = 1411.840'
N 83° 06' 25" E
Sta. 178 + 36.20 E.C.
Δ = 27° 30' 47.91"
R = 1500'
T = 367.230
L = 720.297
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 6
1946
100 FEET 0 100 200
P-1843-57


UPPER ROADWAY
LOWER ROADWAY
CONCRETE VIADUCT
PAVEMENT
1765'-0"
SAN FRANCISCO ANCHORAGE
685'-0"
WEST BAY CROSSING
+3.00%
+3.00%
El. 176.50 U.D.
El. 152.50 L.D.
S.F. ANCHORAGE
W-1
1683'-0"
100'-0"
2 @ 291'-0" = 582'-0"
1450'-0
22'-0"
ELEVATION
Sta. 50+43.01
Sta. 56+36.00
GREENWICH ST.
FILBERT ST.
UNION ST.
GREEN ST.
GRANT AVE.
KEARNY ST.
MONTGOMERY ST.
SANSOME ST.
BATTERY ST.
FRONT ST.
EMBARCADERO
PIER 23
PIER 19
PIER 17
Sta. 38+13.74 B.C.
Sta. 50+73.50 E.C.
Δ = 11° 06' 16"
R = 6,500'
T = 631.86'
L = 1259.76'
N 69° 55' 44" E
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION No. 6
1946
100 FEET 0 100 200
P-1843-56

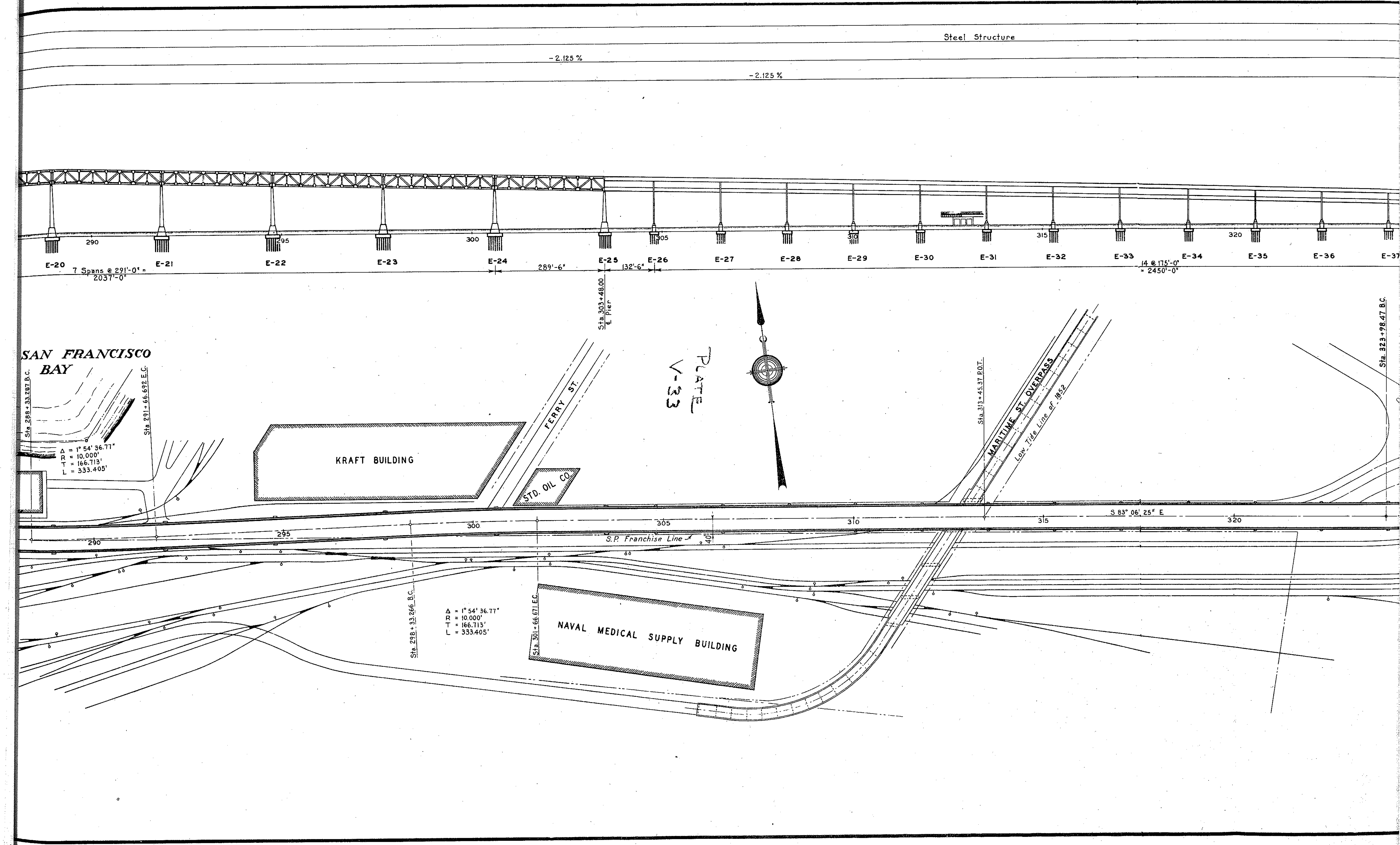

CONCRETE
VIADUCT
160'-0"
UPPER ROADWAY
LOWER ROADWAY
860'-0"
CONCRETE V
PAVEMENT
1,600' V.C.
800' V.C.
Sta. 151+50 E.V.C.
El. 140.00 L.D.
Y. B. ANCHORAGE
288'-0"
25 Spans @ 40'-0" = 1,000'-0"
145
150
N 69°


APPROACH
445'-0"
UPPER ROADWAY CONCRETE VIADUCT
LOWER ROADWAY PAVEMENT
1765'-0"
SAN FRANCISCO ANCHORAGE
685'-0"
WEST BAY CROSSIN
+5.00 %
300' V.C.
+3.00 %
Sta. 33+29.81 B.V.C.
El. 104.23 U.D.
El. 80.23 L.D.
Sta. 36+29.81 E.V.C.
El. 116.23 U.D.
El. 92.23 L.D.
El. 176.50 U.D.
El. 152.50 L.D.
30
35
40
45
50
55
60
S.F. ANCHORAGE
W-1
479'-10"
70'-0"
1683'-0"
100'-0"
2 @ 291'-0" = 582'-0"
22'-0"
1450'-0
Sta. 27+45.13
Sta. 32+25.00
Sta. 50+43.01
Sta. 56+36.00
ELEVATION
GREENWICH ST.
PIER 23
Sta. 38+13.74 B.C.
Sta. 50+73.50 E.C.
Δ = 11° 06' 16"
R = 6,500'
T = 631.86'
L = 1259.76'
N 69° 55' 44" E
FILBERT ST.
EMBARCADERO
UNION ST.
FRONT ST.
POWELL ST.
COLUMBUS AVE.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
MONTGOMERY ST.
SANSOME ST.
BATTERY ST.
GREEN ST.
PLAN
1946
100 FEET


Concrete Structure
600'
200'
400' V.C.
- 4.00 %
350' V.C.
400' V.C.
-4.00 %
350' V.C.
Sta. 333 + 10.50 BVC
El. 79.759 U.D.
Sta. 337 + 10.50 E.V.C.
El. 67.509 U.D.
Sta. 342 + 10.67 BVC
El. 33.881 L.D.
Sta. 342 + 50.50
℄ Pier
Sta. 346 + 10.67 PRVC
El. 21.631 U.D.
Sta. 348 + 57.45 BVC
El. 21.631 U.D.
Sta. 349 + 60.67 EVC
El. 14.631 L.D.
Sta. 350 + 50.50
Sta. 352 + 07.45 EVC
El. 14.631 U.D.
Sta. 362 + 78.92
Sta. 364 + 49.28
23' Clearance
℄ BAY ST.
℄ CEDAR ST.
15' Clearance
335
340
345
350
355
360
365
E-42
E-43
E-44
E-59
13 Spans @ 60'-0" = 780'-0"
80'-0"
15 Spans @ 40'-0" = 600'-0"
200'-0"
Concrete Walls
Plaza 1396'-9"
On Ramp
15 Spans @ 60'-0" = 900'-0"
10 Spans @ 40'-0" = 400'-0"
200'-0"
Concrete Walls
Plaza 1468'-3"
Off Ramp
SOUTHERN PACIFIC MAIN LINE TRACKS
Sta. 338 + 10.18 E.C.
Sta. 354 + 64.19 E.C.
PLATE V-33
Δ = 16° 42' 27."61
R = 5000'
T = 734.22'
L = 1458.02'
ADMINISTRATION BUILDINGS
AND TOLL PLAZA
S 74° 29' 16" E
Sta. 364 + 55.31
Sta. 340 + 06.17 B.C.
Sta. 343 + 38.56 E.C.
S 74° 29' 16" E
Sta. 362 + 81.40
PERALTA ST.
BAY ST.
CEDAR ST.
PINE ST.
FIFTH ST.
WOOD ST.
WILLOW ST.
CAMPBELL ST.
Δ = 8° 37' 09'
R = 10,000'
T = 753.586'
L = 1504.33'
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
OAKLAND LAYOUT
LOCATION No. 6
SCALE IN FEET
1946
P-1843-



Steel Structure
-2.125 %
-2.125 %
400' V.C.
Sta. 333+10.50 B.V.C. El. 79.759 U.D.
Sta. 337+10.50 E.V.C. El. 67.509 U.D.
23' Clearance
℄ Bay St.
PLATE V-33
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
E-37
E-38
E-39
E-40
E-41
E-42
E-43
E-44
289'-6"
132'-6"
14 @ 175'-0" = 2450'-0"
3 Spans @ 100'-0" = 300'-0"
80'-0"
80'-0"
13 Spans @ 60'-0" = 780'-0"
15 Spans @ 60'-0" = 900'-0"
ELEVATION
Sta. 303+48.00 ℄ Pier
PLATE V-33
FERRY ST.
STD. OIL CO.
Sta. 313+45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
Sta. 323+98.47 B.C.
Δ = 8° 05' 18.61"
R = 10,000'
T = 707.03'
L = 1411.71'
SEVENTH ST. SUBWAY
SOUTHERN PACIFIC MAIN LINE TRACKS
Sta. 338+10.18 E.C.
S 83° 06' 25" E
S.P. Franchise Line
40'
Sta. 301+66.67 E.C.
NAVAL MEDICAL SUPPLY BUILDING
Sta. 328+34.23 B.C.
BAY ST.
Δ = 8° 37' 09"
R = 10,000'
T = 753.586'
L = 1504.33'
PLAN



Steel Structure
-2.125 %
-2.125 %
290
295
300
305
310
315
320
E-20
E-21
E-22
E-23
E-24
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
E-37
7 Spans @ 291'-0" = 2037'-0"
289'-6"
132'-6"
14 @ 175'-0" = 2450'-0"
Sta. 303+48.00 ℄ Pier
SAN FRANCISCO BAY
Sta. 288+33.287 B.C.
Sta. 291+66.692 E.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
KRAFT BUILDING
FERRY ST.
STD. OIL CO.
PLATE V-33
Sta. 313+45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
Sta. 323+98.47 B.C.
S 83° 06' 25" E
S.P. Franchise Line
40'
Sta. 298+33.266 B.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
Sta. 301+66.671 E.C.
NAVAL MEDICAL SUPPLY BUILDING

Plate V-34

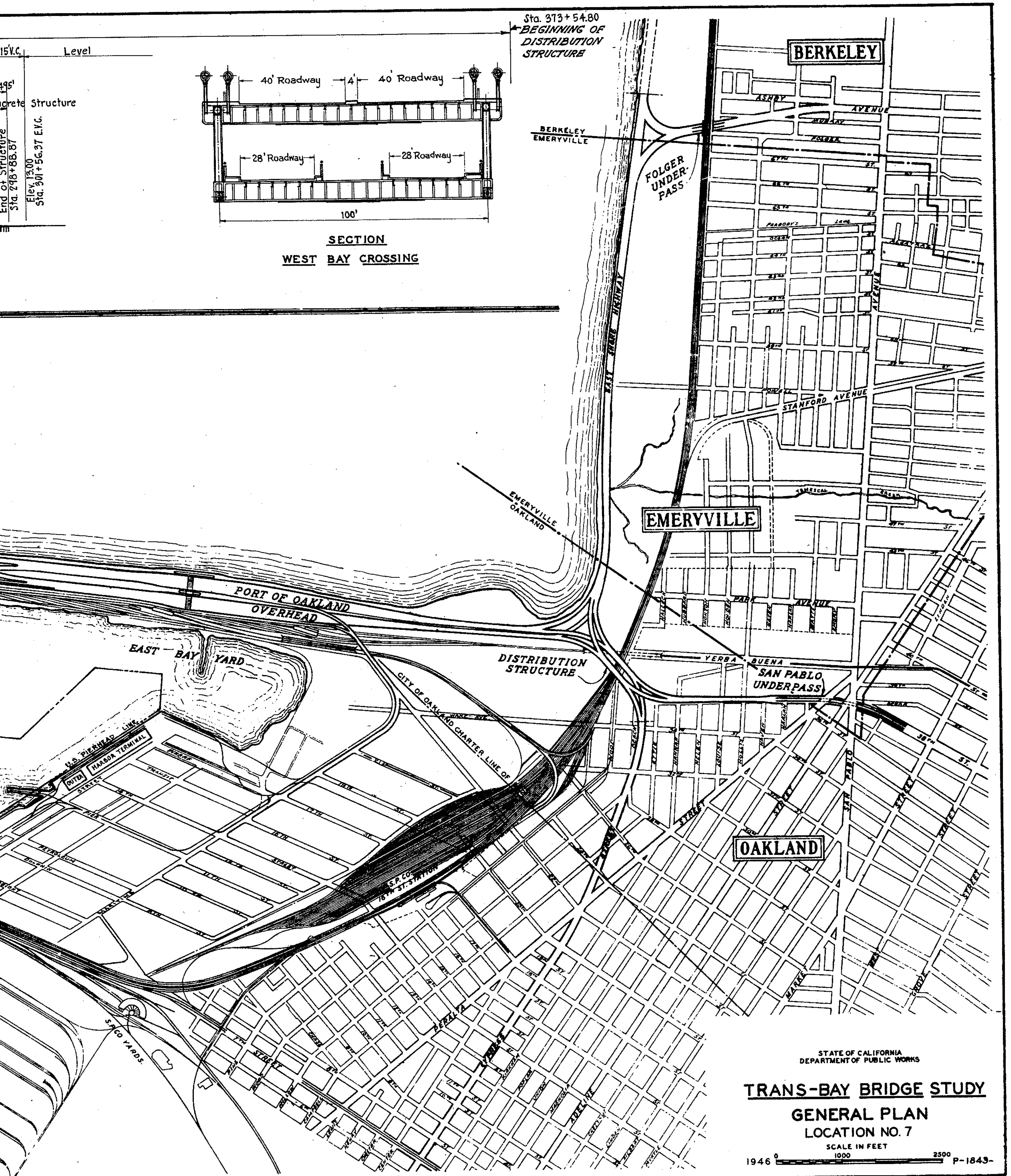
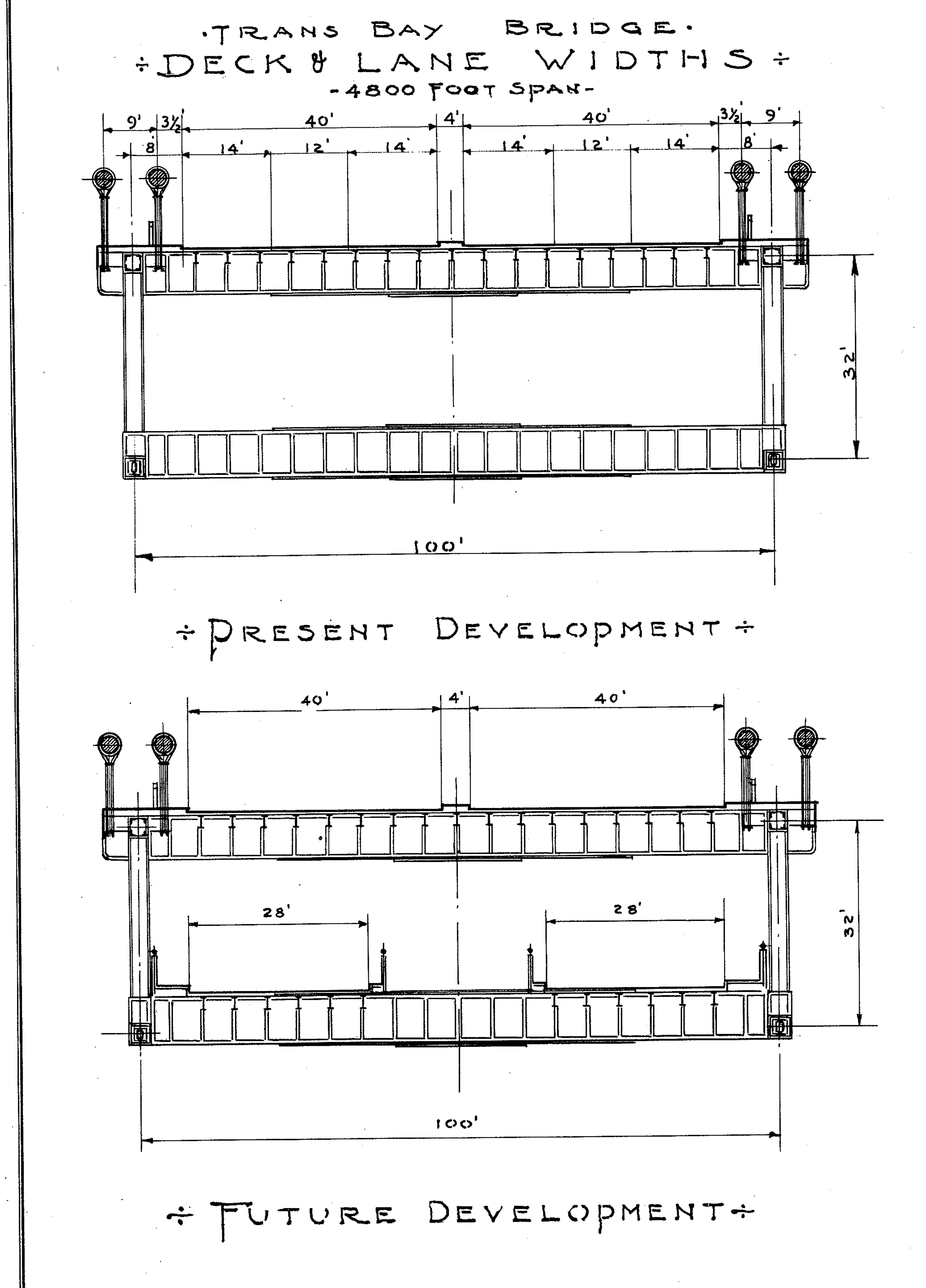
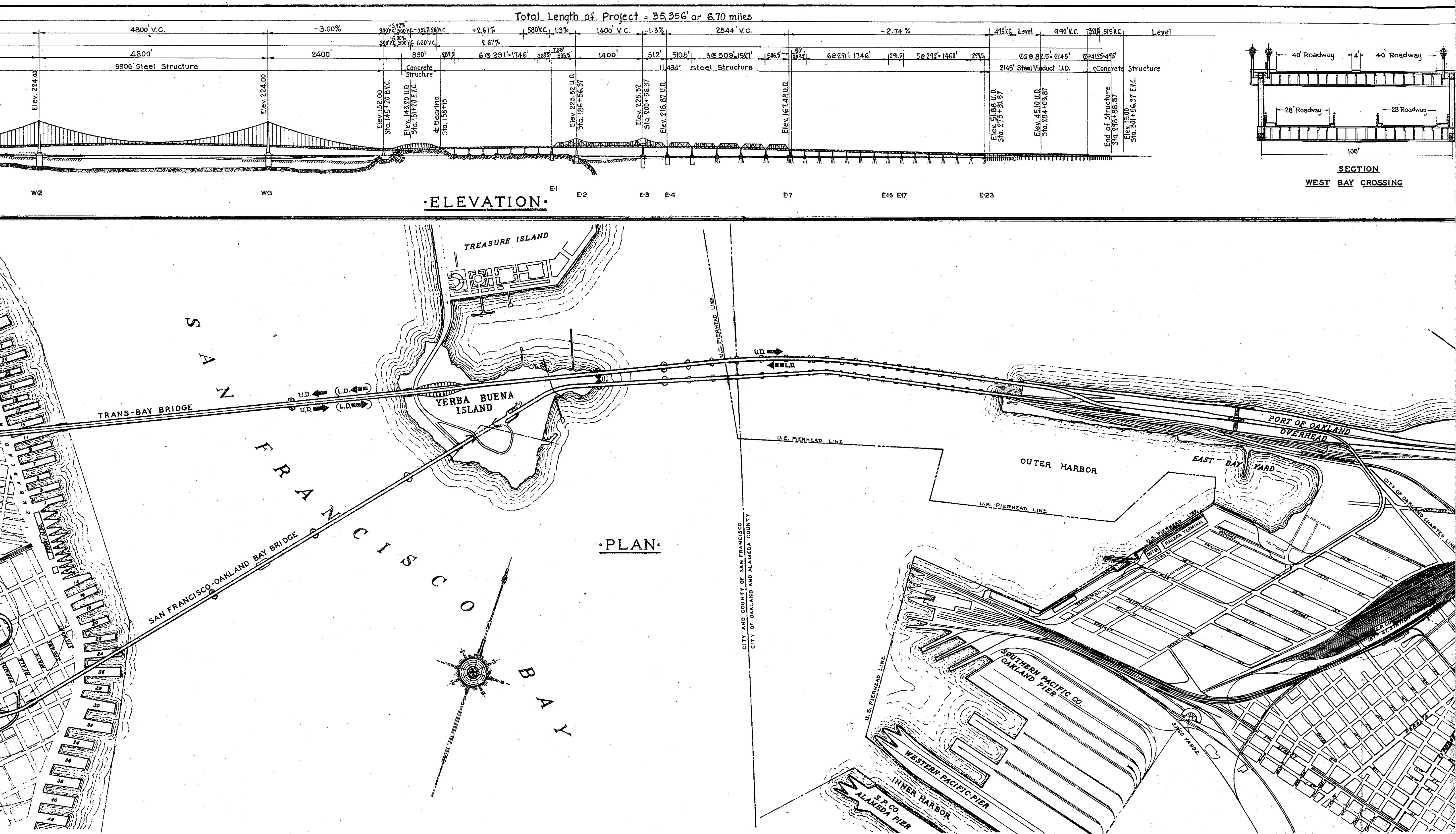
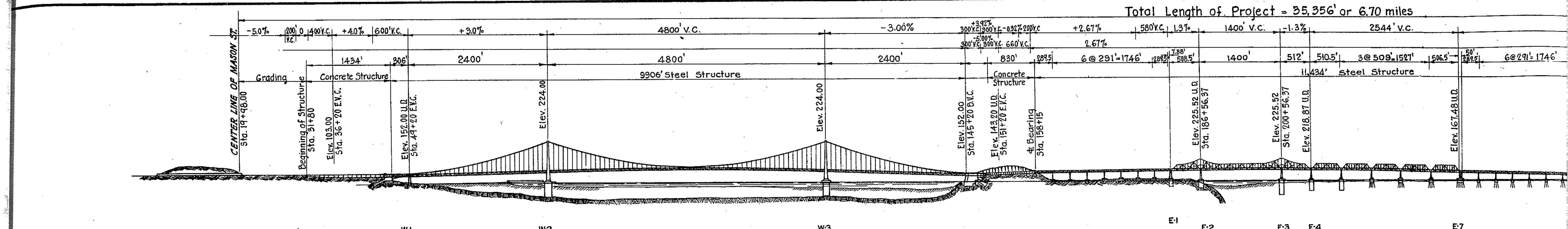


Plate V-35

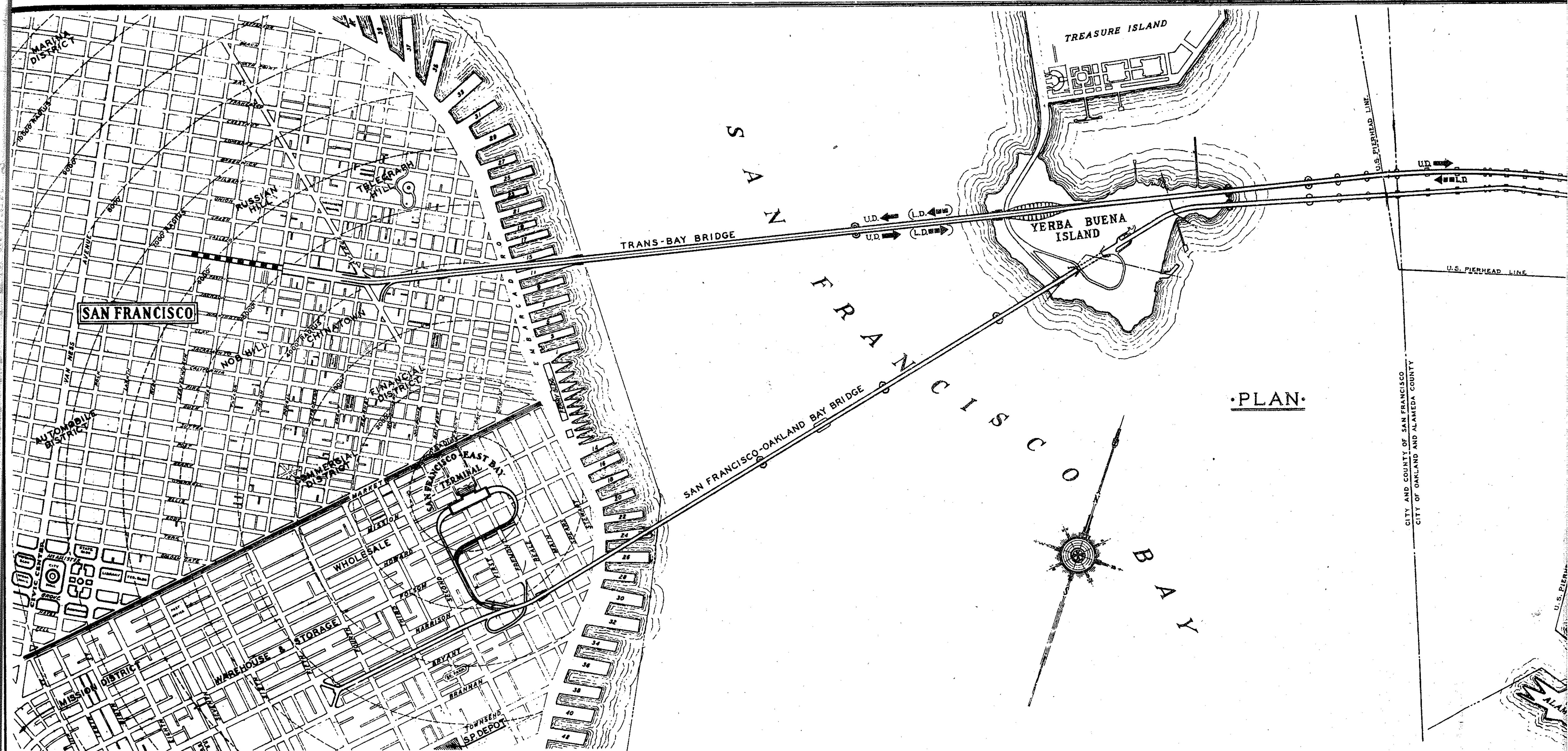




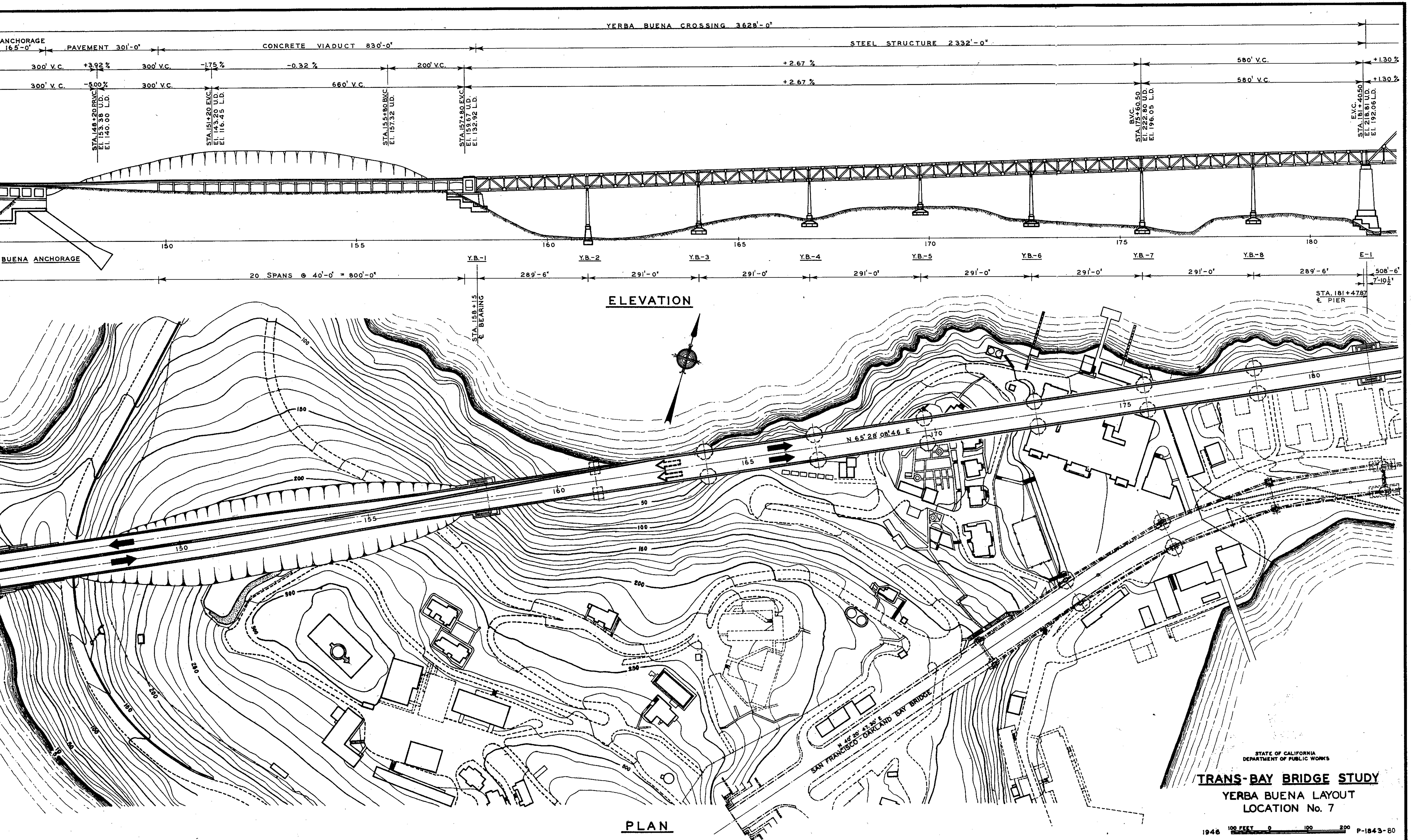
Total Length of Project = 35,356' or 6.70 miles
4800' V.C.
-3.00%
+2.67%
2.67%
1400' V.C.
-1.3%
2544' V.C.
-2.74%
Level
4800'
2400'
830'
6@291'=1746'
1400'
512'
510.5'
3@509'=1527'
6@291'=1746'
5@292'=1460'
26@82.5'=2145'
9906' Steel Structure
Concrete Structure
11,434' Steel Structure
2145' Steel Viaduct U.D.
Concrete Structure
Elev. 224.00
Elev. 224.00
Elev. 152.00
Elev. 143.20 U.D.
℄ Bearing
Elev. 225.52 U.D.
Elev. 225.52
Elev. 218.87 U.D.
Elev. 167.48 U.D.
Elev. 51.88 U.D.
Elev. 45.10 U.D.
End of Structure
Elev. 13.00
W-2
W-3
E-1
E-2
E-3
E-4
E-7
E-16
E-17
E-23
·ELEVATION·
40' Roadway
4'
40' Roadway
28' Roadway
28' Roadway
100'
SECTION
WEST BAY CROSSING
TREASURE ISLAND
YERBA BUENA ISLAND
TRANS-BAY BRIDGE
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN FRANCISCO BAY
·PLAN·
U.D.
L.D.
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
OUTER HARBOR
PORT OF OAKLAND OVERHEAD
EAST BAY YARD
HARBOR TERMINAL
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
S.P. CO. YARDS
CITY OF OAKLAND CHARTER LINE

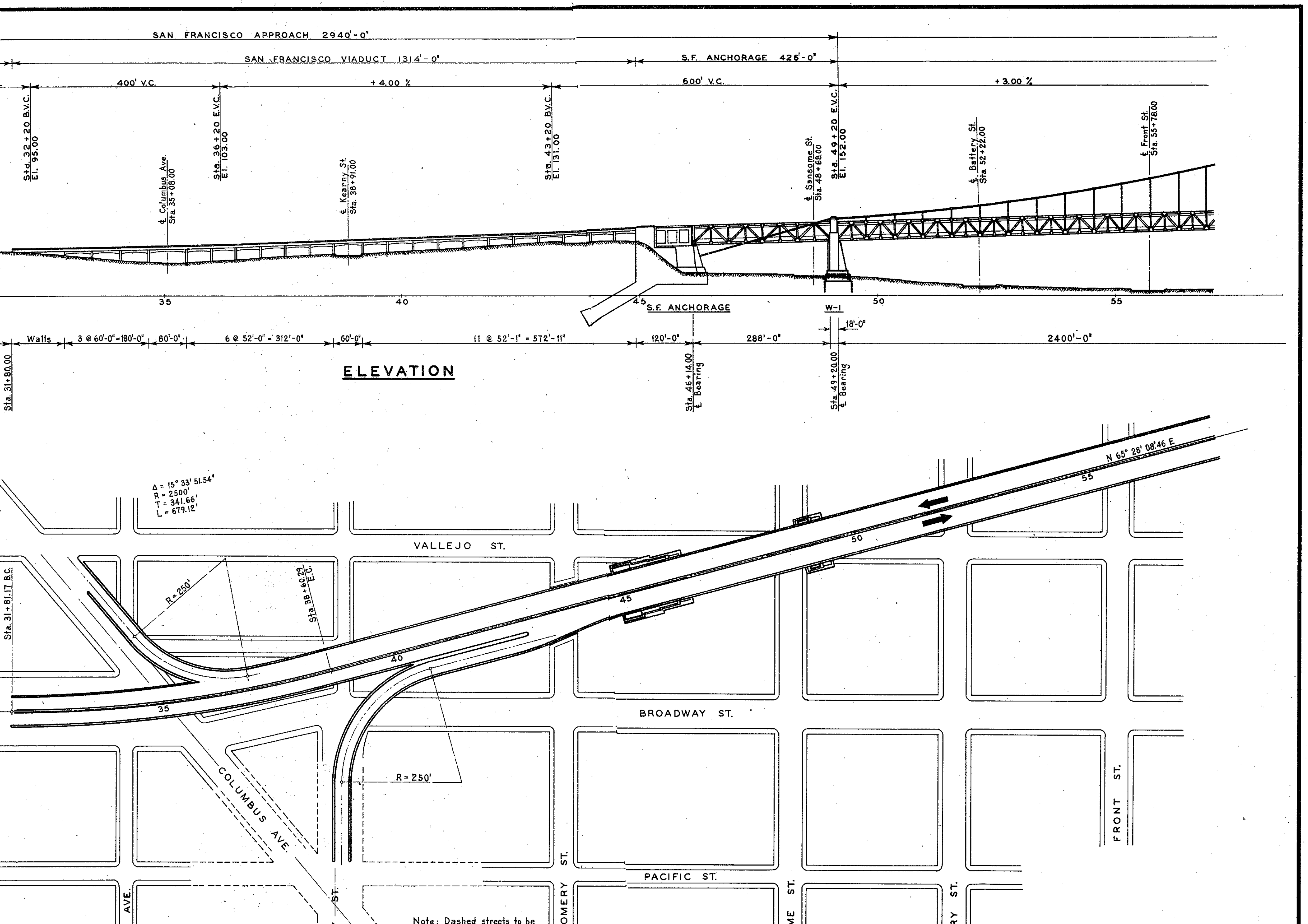


·ELEVATION·



·PLAN·


YERBA BUENA CROSSING 3628'-0"
ANCHORAGE 165'-0"
PAVEMENT 301'-0"
CONCRETE VIADUCT 830'-0"
STEEL STRUCTURE 2332'-0"
300' V.C.
+3.92 %
300' V.C.
-1.75 %
-0.32 %
200' V.C.
+2.67 %
580' V.C.
+1.30 %
300' V.C.
-5.00 %
300' V.C.
660' V.C.
+2.67 %
580' V.C.
+1.30 %
STA. 148+20 PRVC
El. 153.38 U.D.
El. 140.00 L.D.
STA. 151+20 EVC
El. 143.20 U.D.
El. 116.45 L.D.
STA. 155+80 BVC
El. 157.32 U.D.
STA. 157+80 EVC
El. 159.67 U.D.
El. 132.92 L.D.
B.V.C.
STA. 175+60.50
El. 222.80 U.D.
El. 196.05 L.D.
E.V.C.
STA. 181+40.50
El. 218.81 U.D.
El. 192.06 L.D.
150
155
160
165
170
175
180
BUENA ANCHORAGE
Y.B.-1
Y.B.-2
Y.B.-3
Y.B.-4
Y.B.-5
Y.B.-6
Y.B.-7
Y.B.-8
E-1
20 SPANS @ 40'-0" = 800'-0"
289'-6"
291'-0"
291'-0"
291'-0"
291'-0"
291'-0"
291'-0"
289'-6"
508'-6"
7'-10½"
STA. 181+47.87
℄ PIER
STA. 158+15
℄ BEARING
ELEVATION
N 65° 28' 08.46" E
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 7
1946
100 FEET 0 100 200
P-1843-80

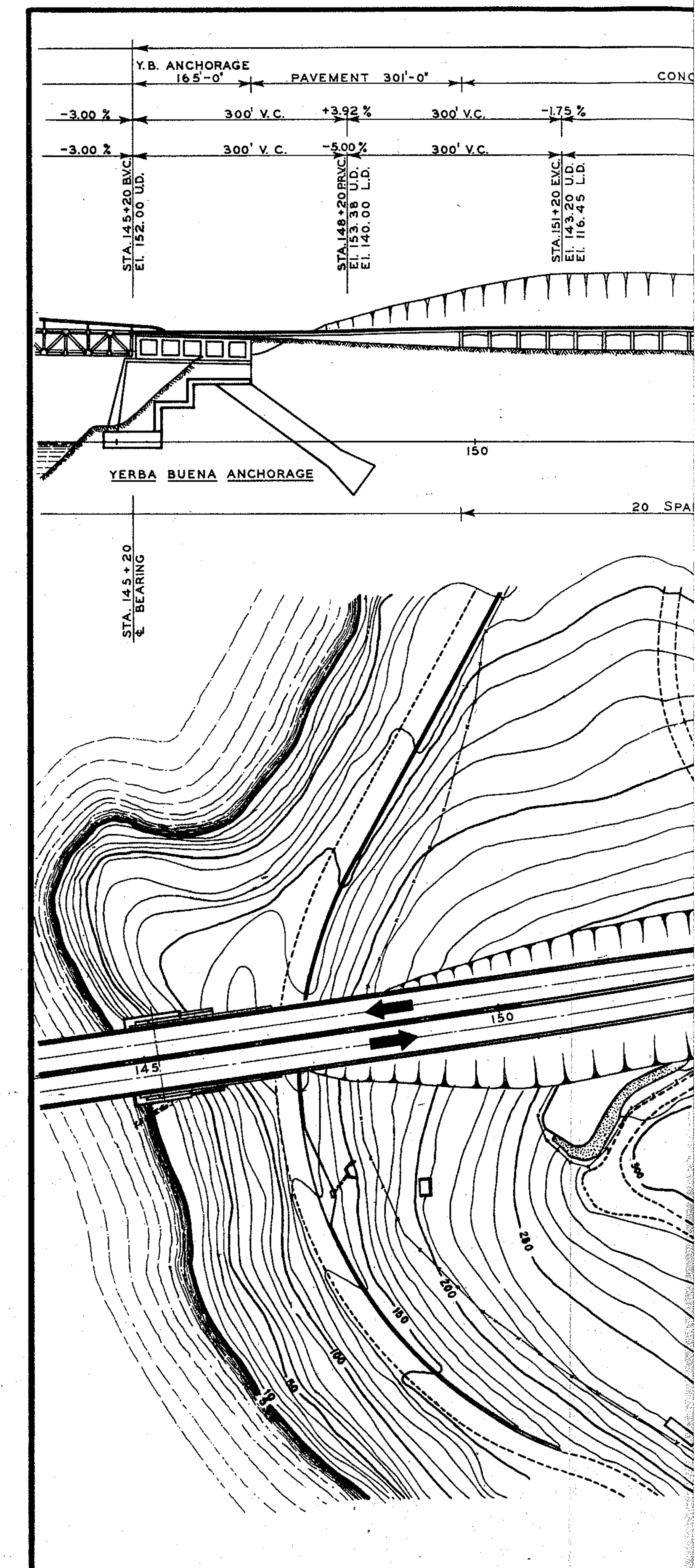


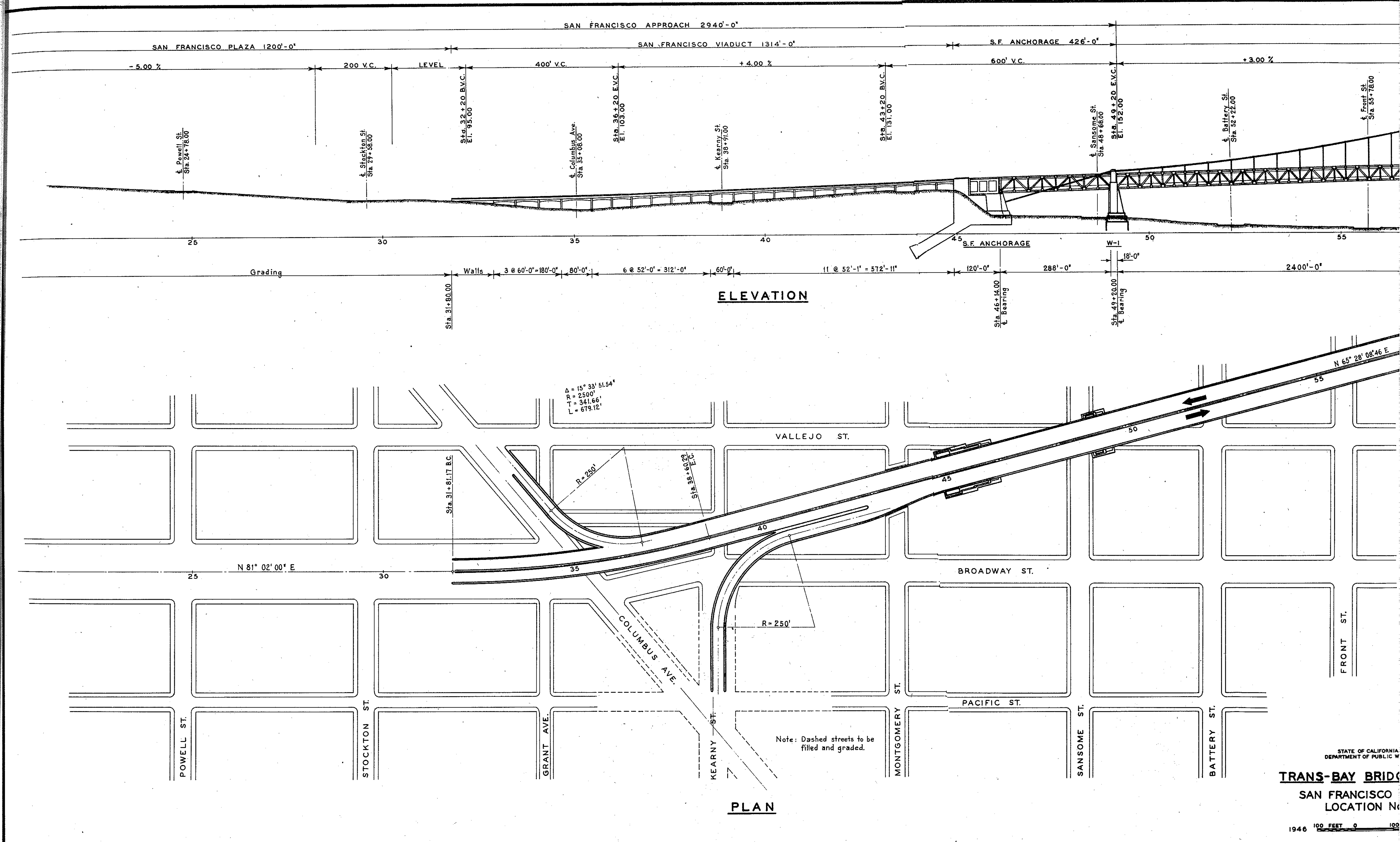
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

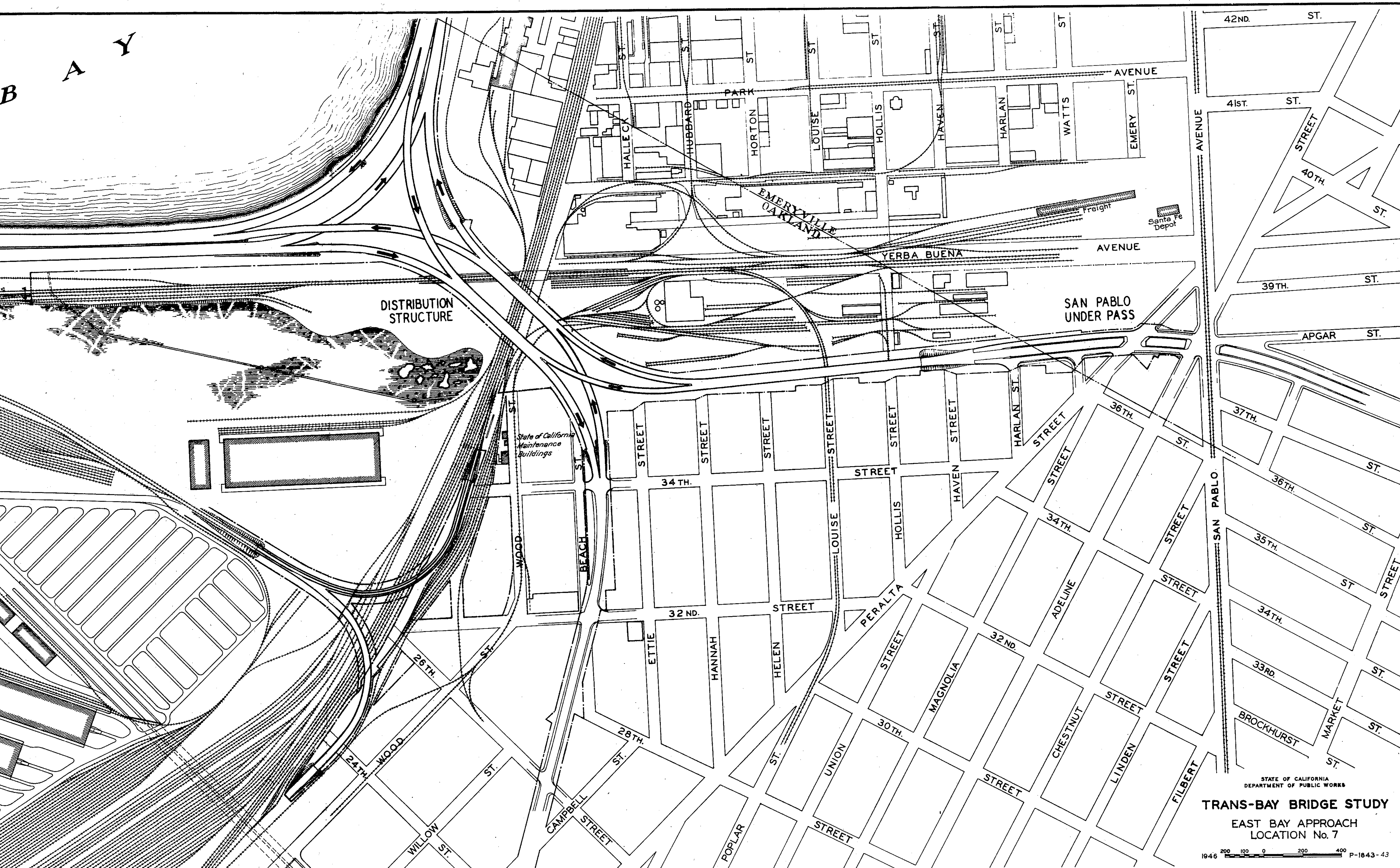
TRANS-BAY BRIDGE STUDY

SAN FRANCISCO LAYOUT
LOCATION No. 7

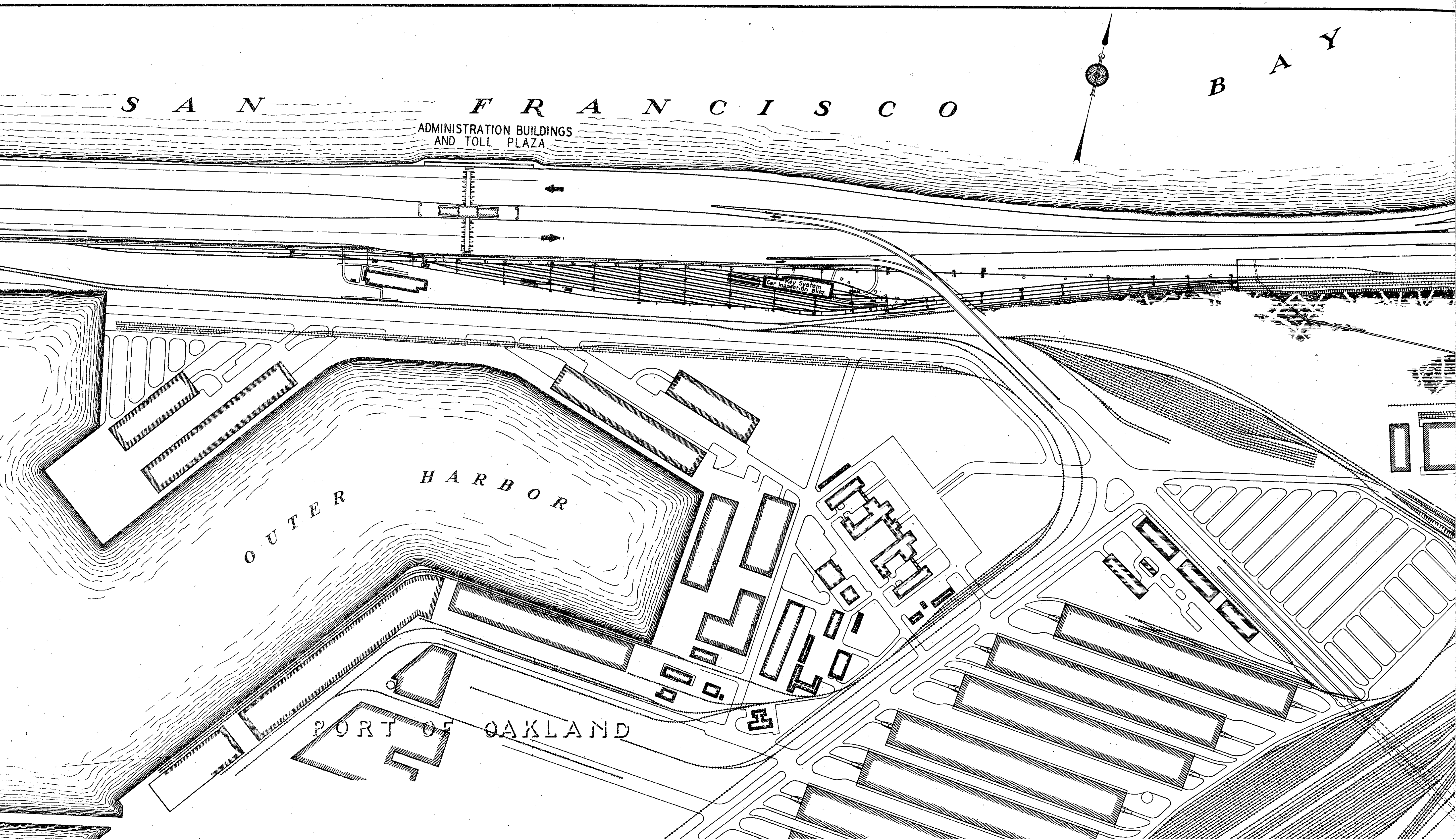
1946 100 FEET 0 100 200 P-1843-78

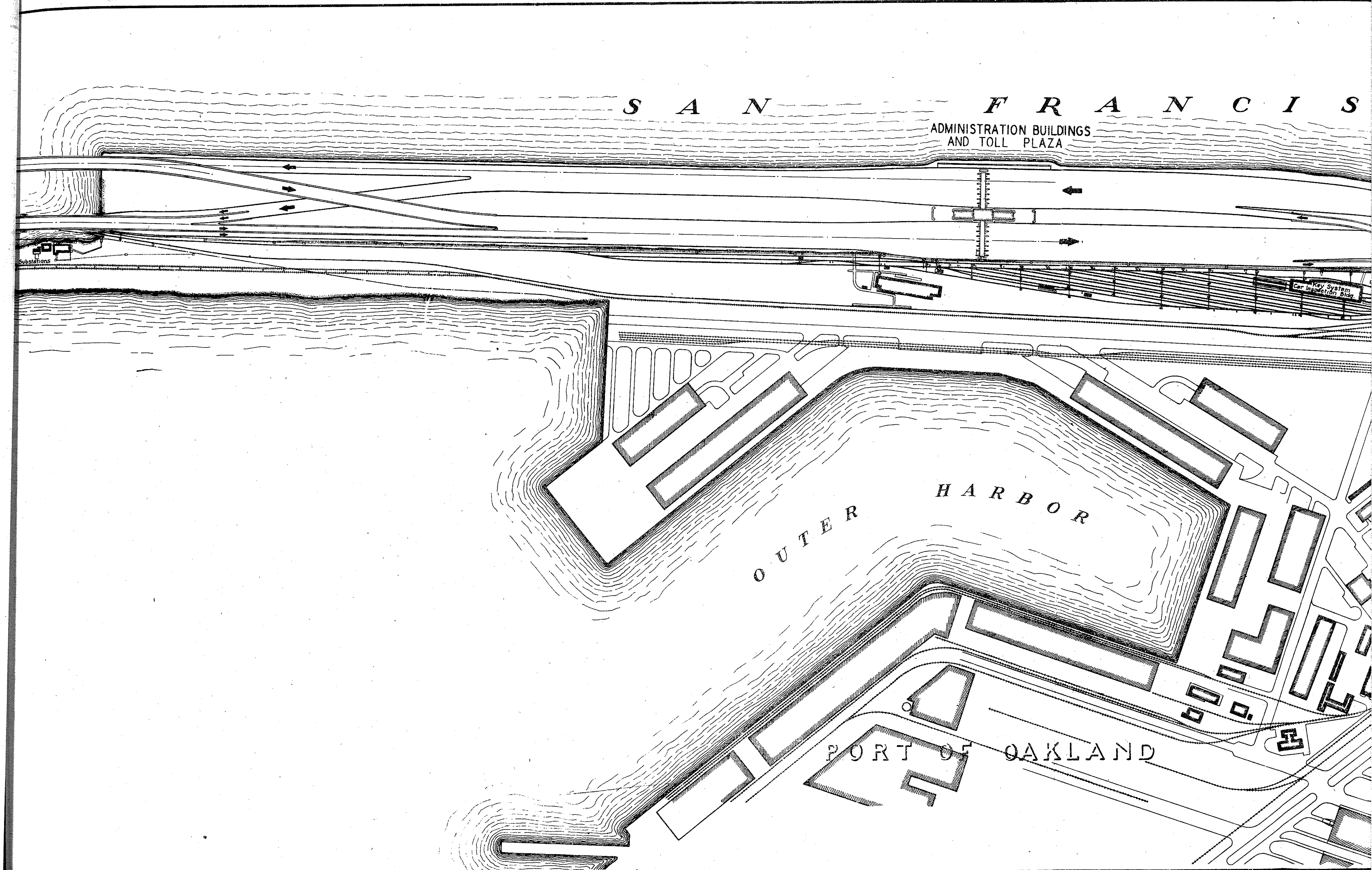


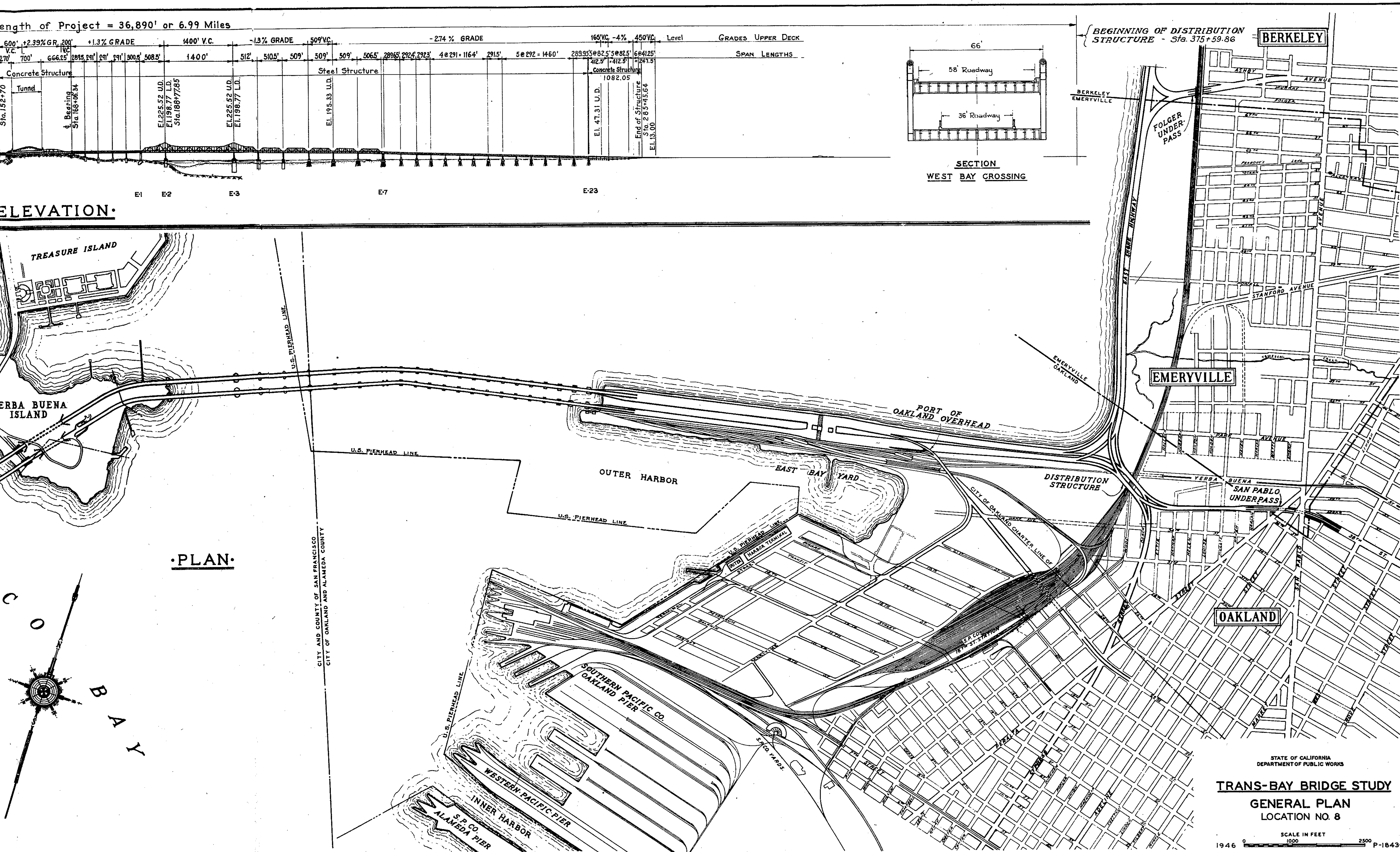

SAN FRANCISCO APPROACH 2940'-0"
SAN FRANCISCO PLAZA 1200'-0"
SAN FRANCISCO VIADUCT 1314'-0"
S.F. ANCHORAGE 426'-0"
-5.00 %
200' V.C.
LEVEL
400' V.C.
+4.00 %
600' V.C.
+3.00 %
℄ Powell St. Sta. 24+78.00
℄ Stockton St. Sta. 29+58.00
Sta. 32+20 B.V.C. El. 95.00
℄ Columbus Ave. Sta. 35+08.00
Sta. 36+20 E.V.C. El. 103.00
℄ Kearny St. Sta. 38+91.00
Sta. 43+20 B.V.C. El. 131.00
℄ Sansome St. Sta. 48+68.00
Sta. 49+20 E.V.C. El. 152.00
℄ Battery St. Sta. 52+22.00
℄ Front St. Sta. 55+78.00
25
30
35
40
45
50
55
S.F. ANCHORAGE
W-1
Grading
Walls
3 @ 60'-0" = 180'-0"
80'-0"
6 @ 52'-0" = 312'-0"
60'-0"
11 @ 52'-1" = 572'-11"
120'-0"
288'-0"
18'-0"
2400'-0"
Sta. 31+80.00
Sta. 46+14.00 ℄ Bearing
Sta. 49+20.00 ℄ Bearing
ELEVATION
Δ = 15° 33' 51.54"
R = 2500'
T = 341.66'
L = 679.12'
N 65° 28' 08.46" E
VALLEJO ST.
R = 250'
Sta. 31+81.17 B.C.
Sta. 38+60.29 E.C.
N 81° 02' 00" E
BROADWAY ST.
COLUMBUS AVE.
R = 250'
PACIFIC ST.
POWELL ST.
STOCKTON ST.
GRANT AVE.
KEARNY ST.
MONTGOMERY ST.
SANSOME ST.
BATTERY ST.
FRONT ST.
Note: Dashed streets to be filled and graded.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC W
TRANS-BAY BRIDG
SAN FRANCISCO
LOCATION N
1946
100 FEET 0 100

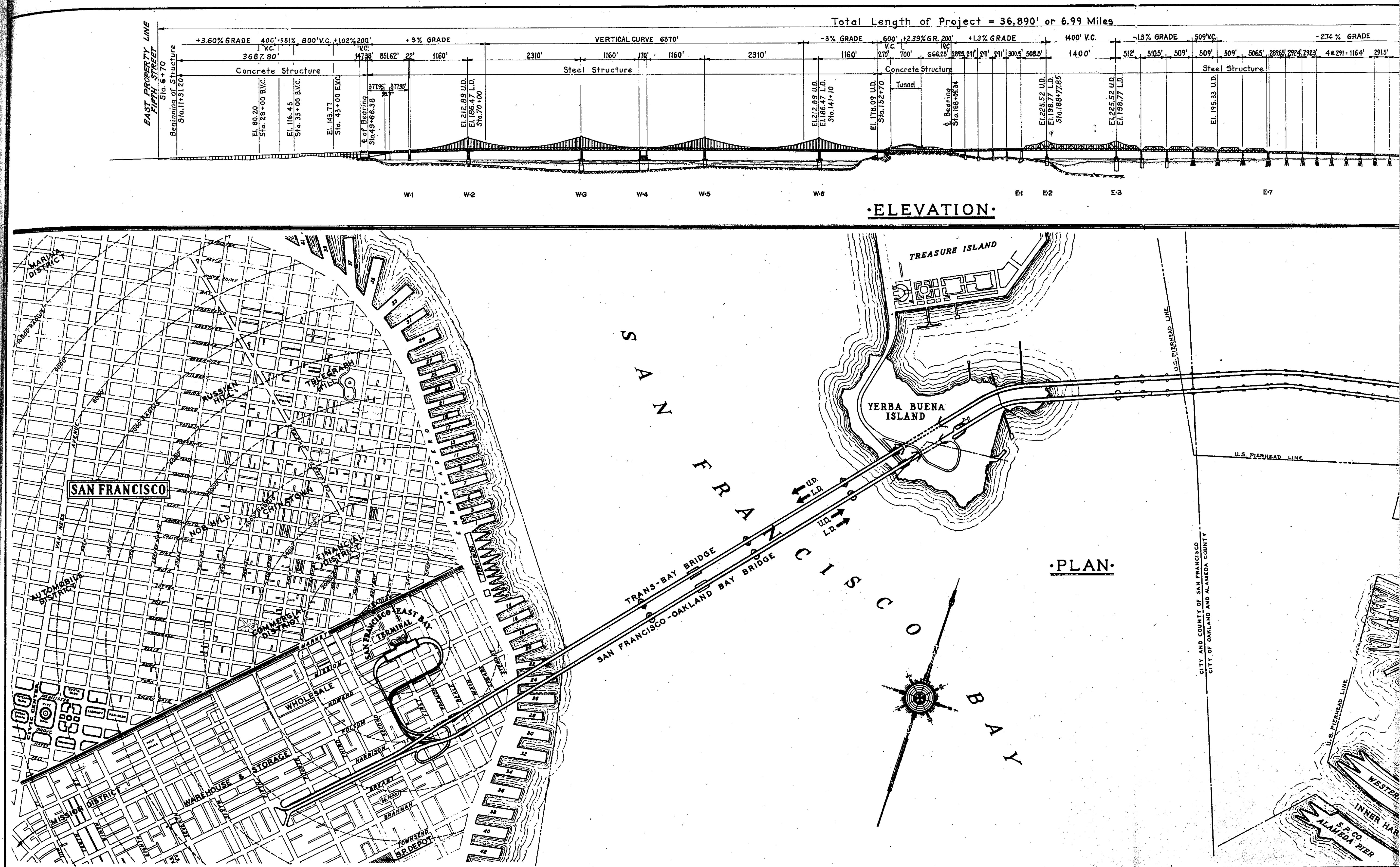


B A Y
DISTRIBUTION STRUCTURE
State of California Maintenance Buildings
EMERYVILLE
OAKLAND
PARK AVENUE
YERBA BUENA AVENUE
SAN PABLO UNDER PASS
Freight
Santa Fe Depot
42ND. ST.
41ST. ST.
40TH. ST.
39TH. ST.
APGAR ST.
37TH. ST.
36TH. ST.
35TH. ST.
34TH. ST.
33RD. ST.
34TH. STREET
32ND. STREET
28TH. ST.
26TH. ST.
24TH. ST.
30TH. STREET
BROCKHURST ST.
SAN PABLO AVENUE
HALLECK ST.
HUBBARD ST.
HORTON ST.
LOUISE STREET
HOLLIS STREET
HAVEN STREET
HARLAN ST.
WATTS ST.
EMERY ST.
WOOD ST.
BEACH ST.
ETTIE
HANNAH
HELEN
PERALTA ST.
UNION STREET
MAGNOLIA STREET
ADELINE STREET
CHESTNUT STREET
LINDEN STREET
FILBERT STREET
MARKET STREET
POPLAR STREET
CAMPBELL STREET
WILLOW ST.
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
EAST BAY APPROACH
LOCATION No. 7
1946
200 100 0 200 400
P-1843-43


SAN FRANCISCO BAY
ADMINISTRATION BUILDINGS
AND TOLL PLAZA
Key System
Car Inspection Bldg.
OUTER HARBOR
PORT OF OAKLAND


SAN FRANCIS
ADMINISTRATION BUILDINGS
AND TOLL PLAZA
Substations
Key System
Car Inspection Bldg.
OUTER HARBOR
PORT OF OAKLAND


Length of Project = 36,890' or 6.99 Miles
Concrete Structure
Steel Structure
Tunnel
Grades Upper Deck
Span Lengths
BEGINNING OF DISTRIBUTION STRUCTURE - Sta. 375+59.86
ELEVATION
66'
58' Roadway
36' Roadway
SECTION
WEST BAY CROSSING
BERKELEY
EMERYVILLE
OAKLAND
TREASURE ISLAND
YERBA BUENA ISLAND
PLAN
U.S. PIERHEAD LINE
OUTER HARBOR
PORT OF OAKLAND OVERHEAD
EAST BAY YARD
DISTRIBUTION STRUCTURE
FOLGER UNDER-PASS
SAN PABLO UNDERPASS
EAST SHORE HIGHWAY
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
S.P. CO. YARDS
BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 8
SCALE IN FEET
0
1000
2500
1946
P-1843



Total Length of Project = 36,890' or 6.99 Miles
EAST PROPERTY LINE FIFTH STREET
Sta. 6+70
Beginning of Structure Sta. 11+31.20
+3.60% GRADE
+3% GRADE
VERTICAL CURVE 6370'
-3% GRADE
+1.3% GRADE
1400' V.C.
-1.3% GRADE
-2.74 % GRADE
Concrete Structure
Steel Structure
Tunnel
W-1
W-2
W-3
W-4
W-5
W-6
E-1
E-2
E-3
E-7
·ELEVATION·
·PLAN·
TREASURE ISLAND
YERBA BUENA ISLAND
SAN FRANCISCO BAY
SAN FRANCISCO
TRANS-BAY BRIDGE
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN FRANCISCO-EAST BAY TERMINAL
U.S. PIERHEAD LINE
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
MARINA DISTRICT
RUSSIAN HILL
TELEGRAPH HILL
NOB HILL
CHINATOWN
FINANCIAL DISTRICT
COMMERCIAL DISTRICT
AUTOMOBILE DISTRICT
WHOLESALE
WAREHOUSE & STORAGE
MISSION DISTRICT
CIVIC CENTER
EMBARCADERO
MARKET
MISSION
HOWARD
FOLSOM
HARRISON
BRYANT
BRANNAN
TOWNSEND
S.P. DEPOT
VAN NESS AVENUE
S.P. CO. ALAMEDA PIER
INNER HAR
WESTER

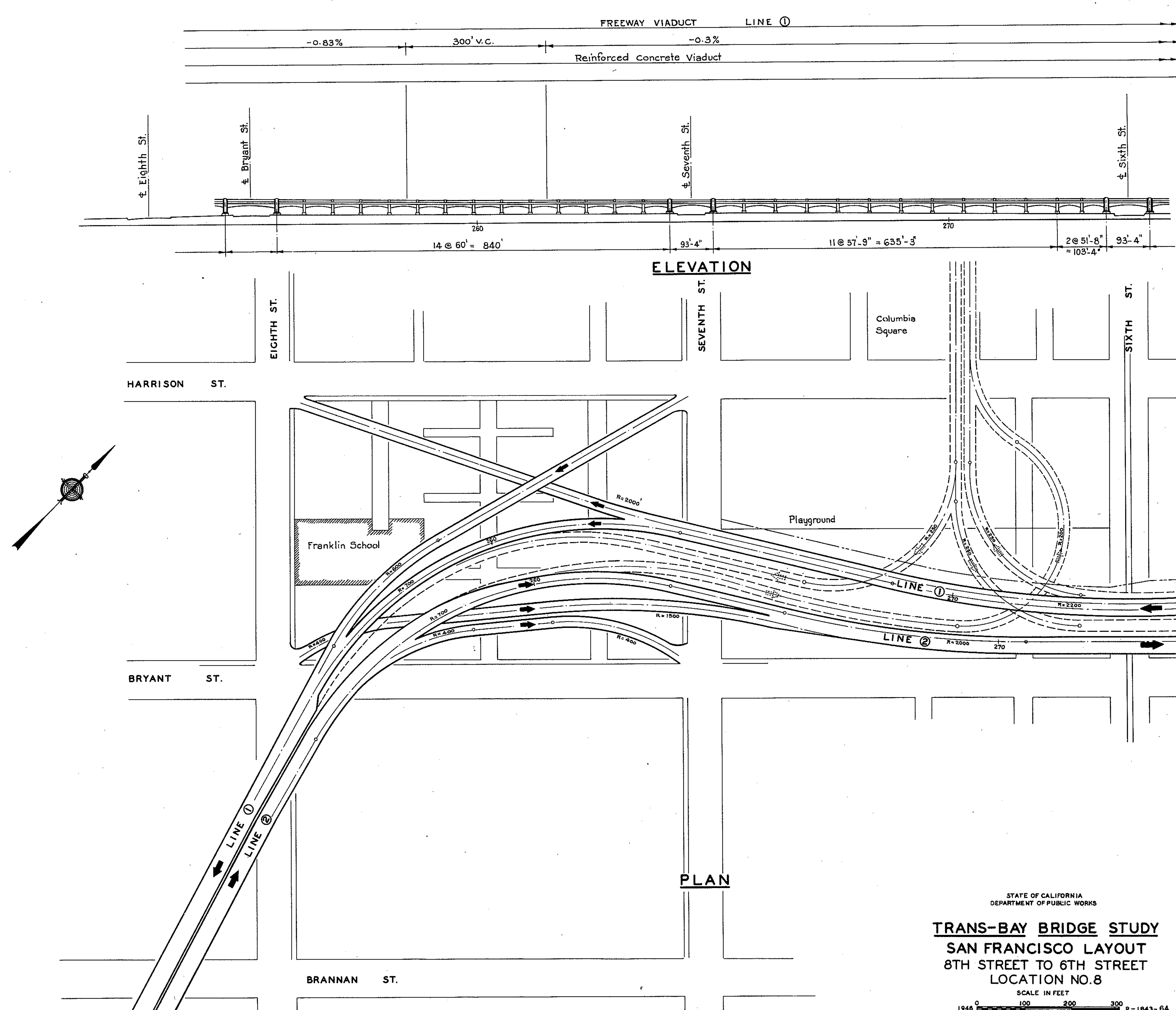

FREEWAY VIADUCT LINE ①
-0.83%
300' V.C.
-0.3%
Reinforced Concrete Viaduct
℄ Eighth St.
℄ Bryant St.
℄ Seventh St.
℄ Sixth St.
260
270
14 @ 60' = 840'
93'-4"
11 @ 57'-9" = 635'-3"
2 @ 51'-8" = 103'-4"
93'-4"
ELEVATION
EIGHTH ST.
SEVENTH ST.
SIXTH ST.
HARRISON ST.
BRYANT ST.
BRANNAN ST.
Columbia Square
Playground
Franklin School
R=2000'
R=2200
R=2000
R=1500
R=600
R=700
R=400
LINE ①
LINE ②
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
8TH STREET TO 6TH STREET
LOCATION NO. 8
SCALE IN FEET
0 100 200 300
1946
P-1843-64

Plate V-40

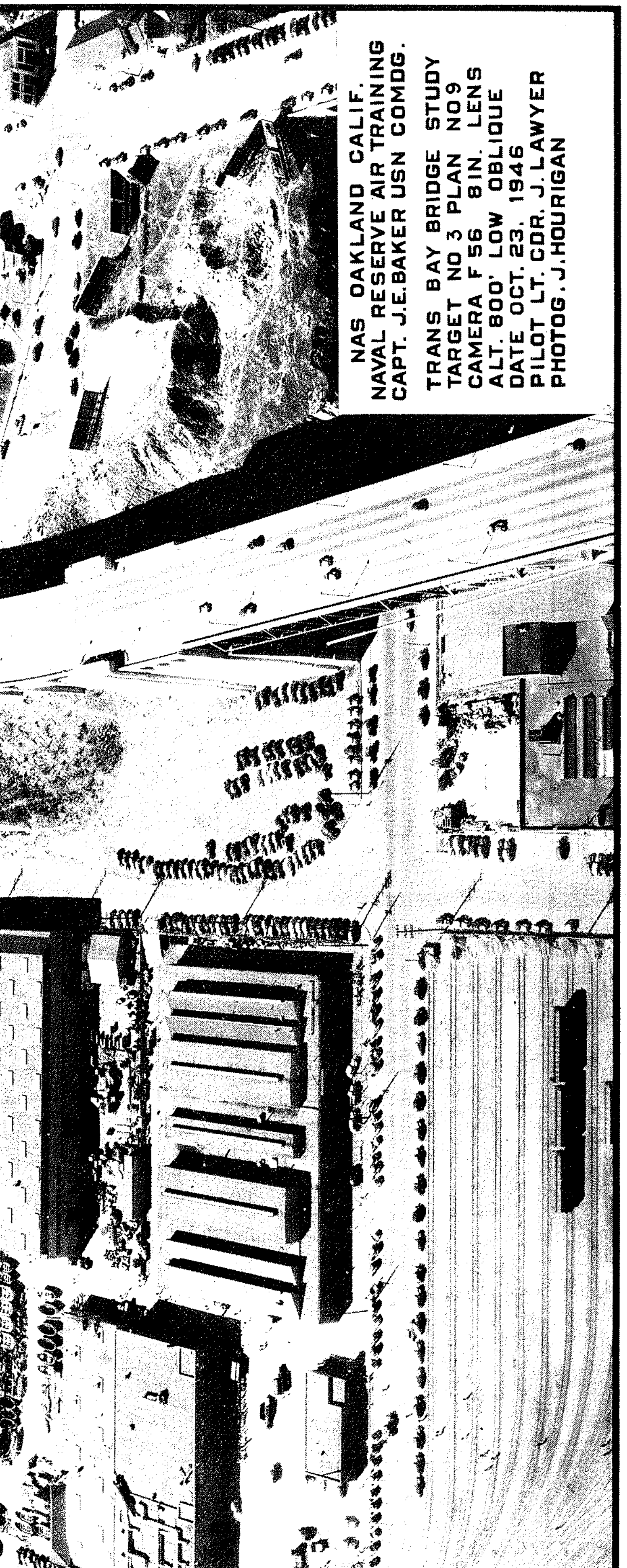
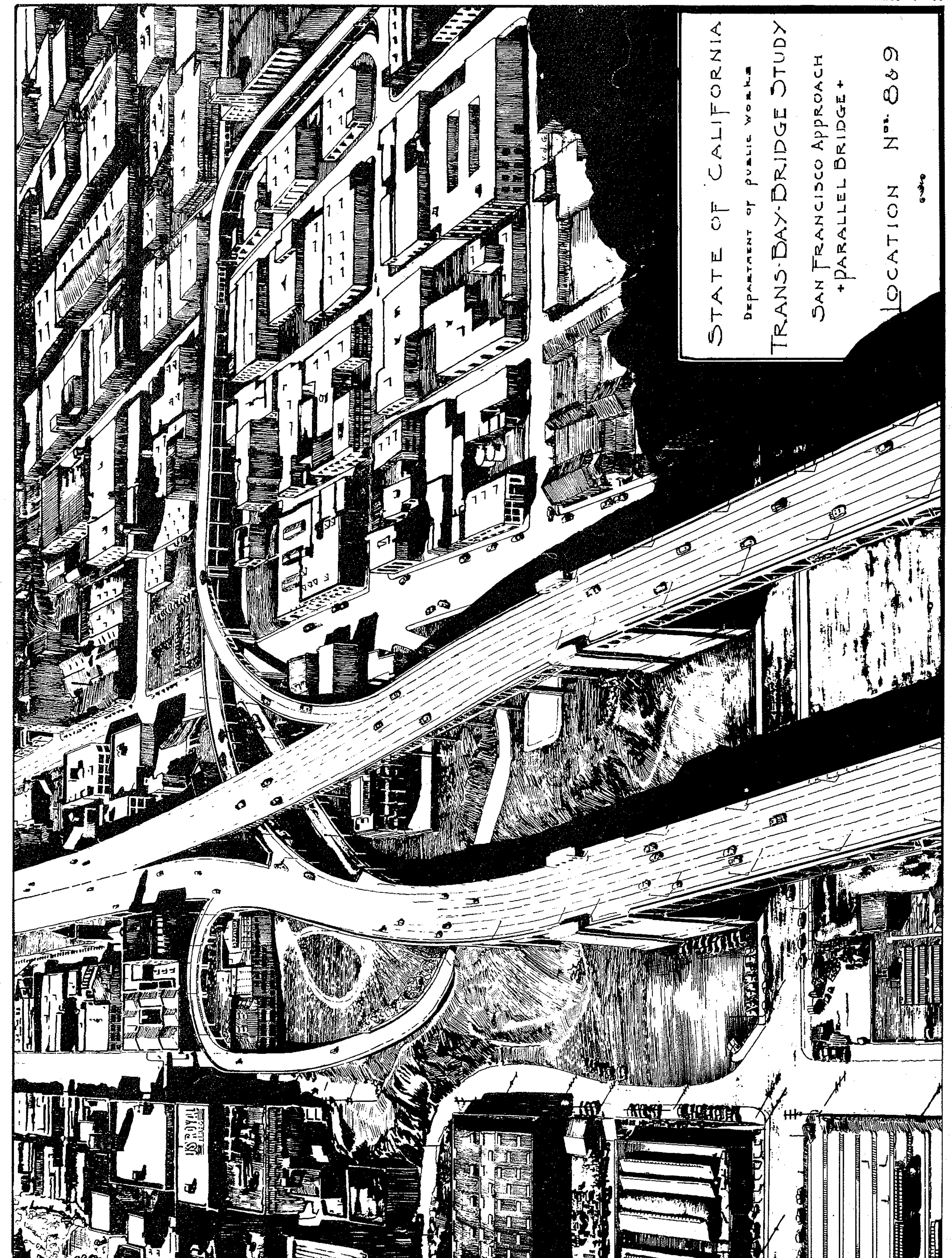
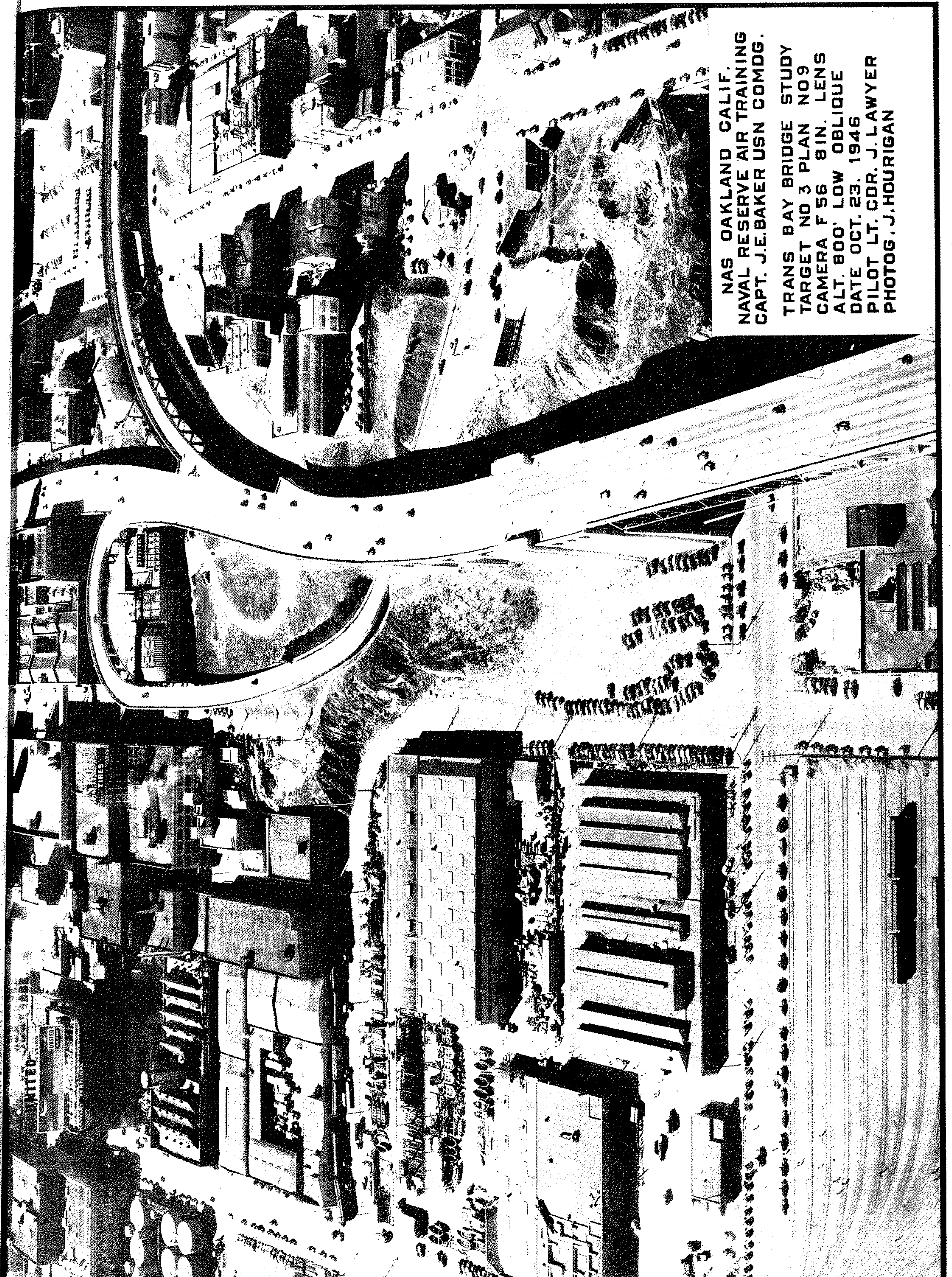
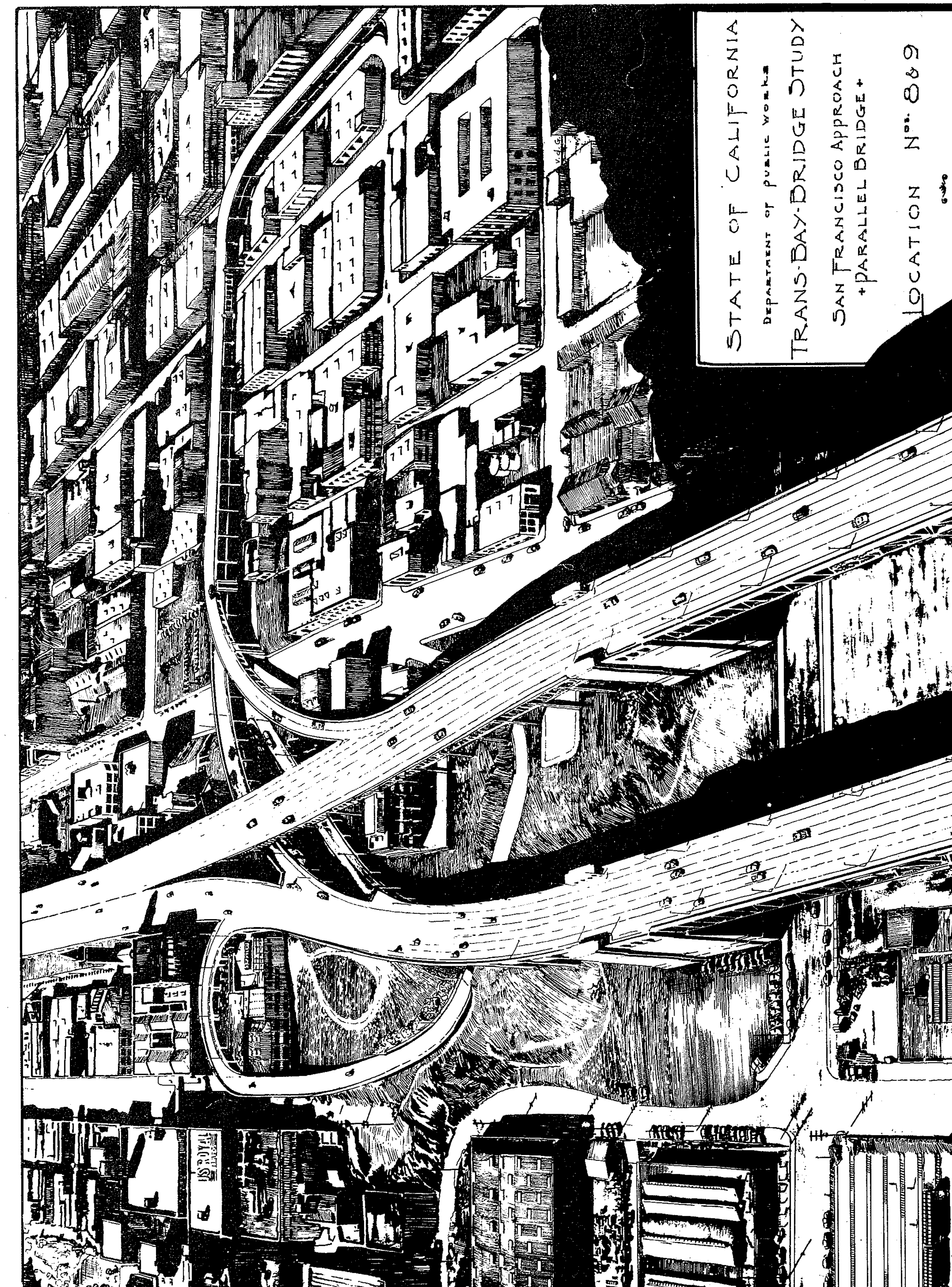
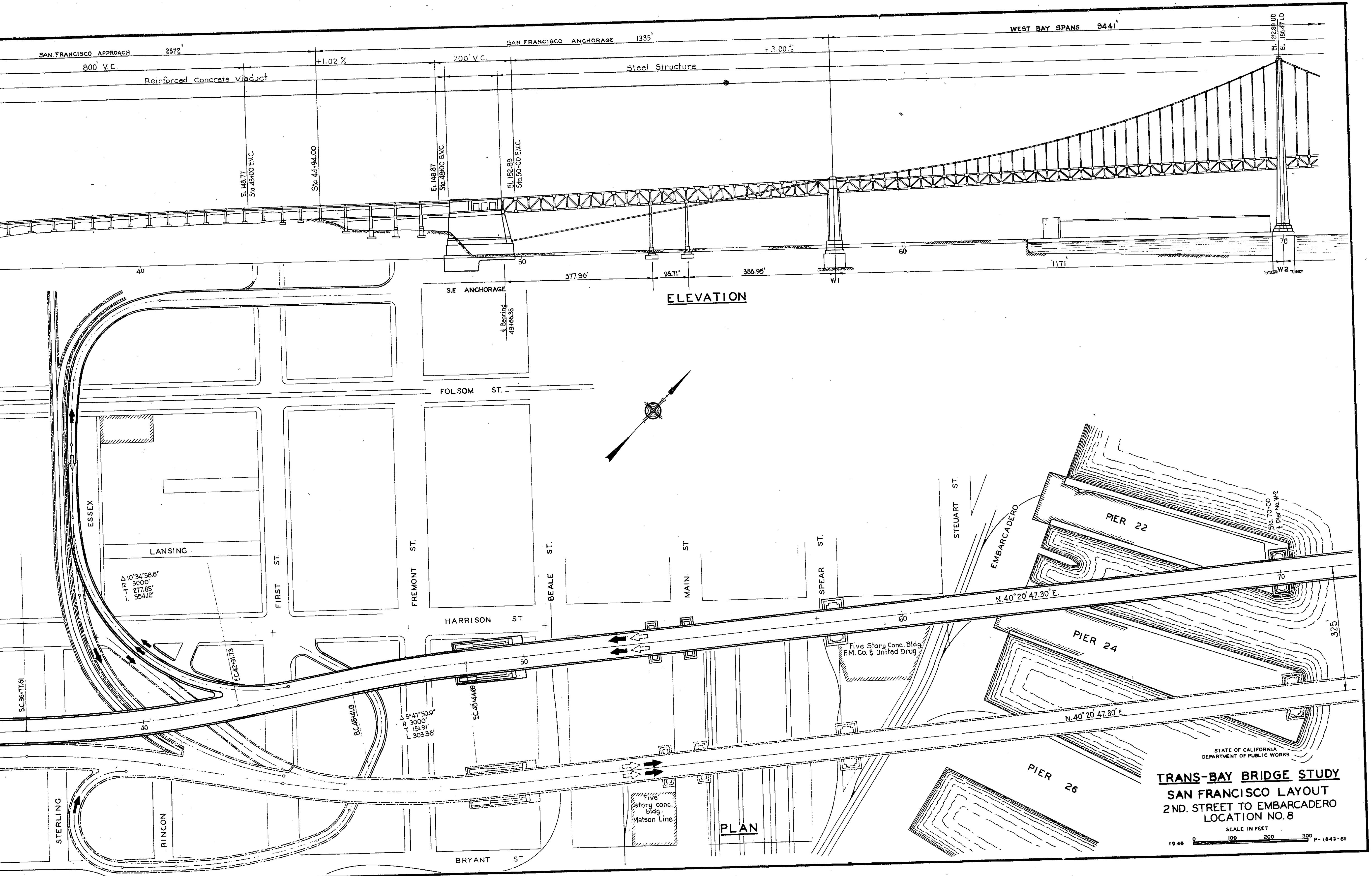


Plate V-41

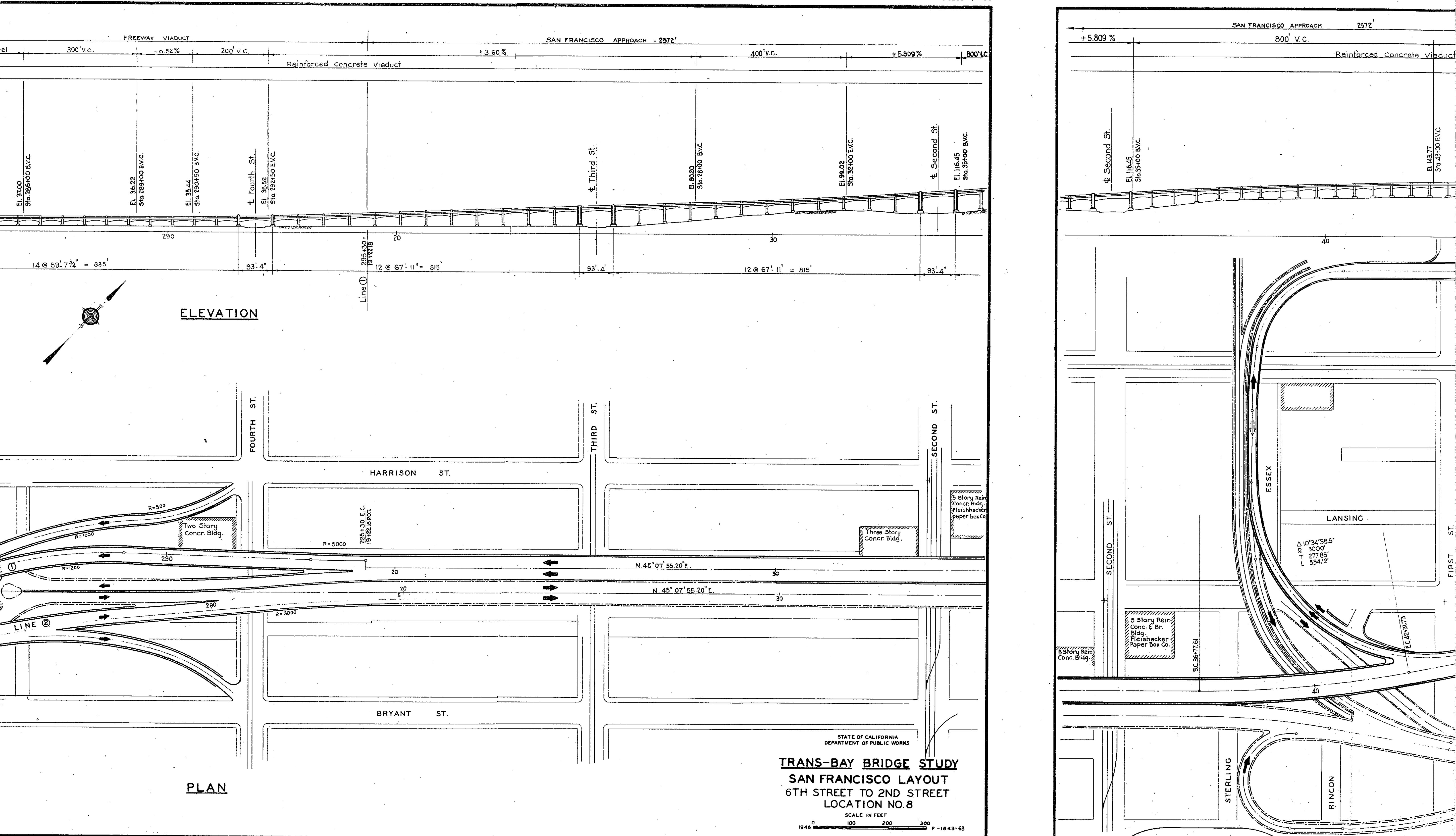



NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 3 PLAN NO9
CAMERA F56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. J. LAWYER
PHOTOG. J.HOURIGAN

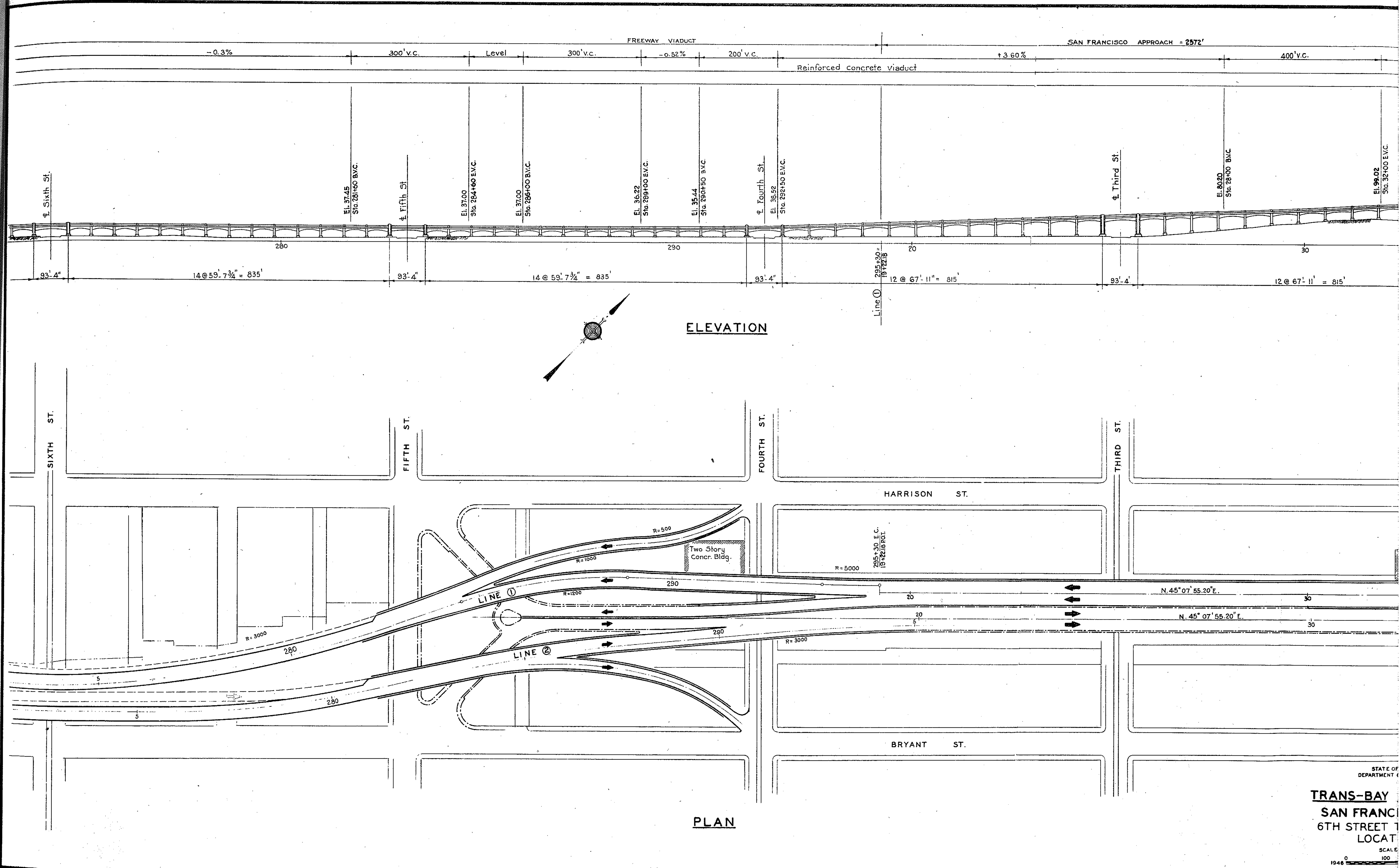

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY-BRIDGE STUDY
SAN FRANCISCO APPROACH
+PARALLEL BRIDGE+
LOCATION No. 869

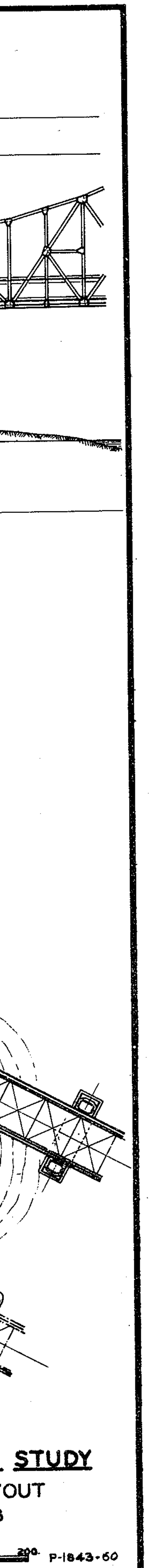


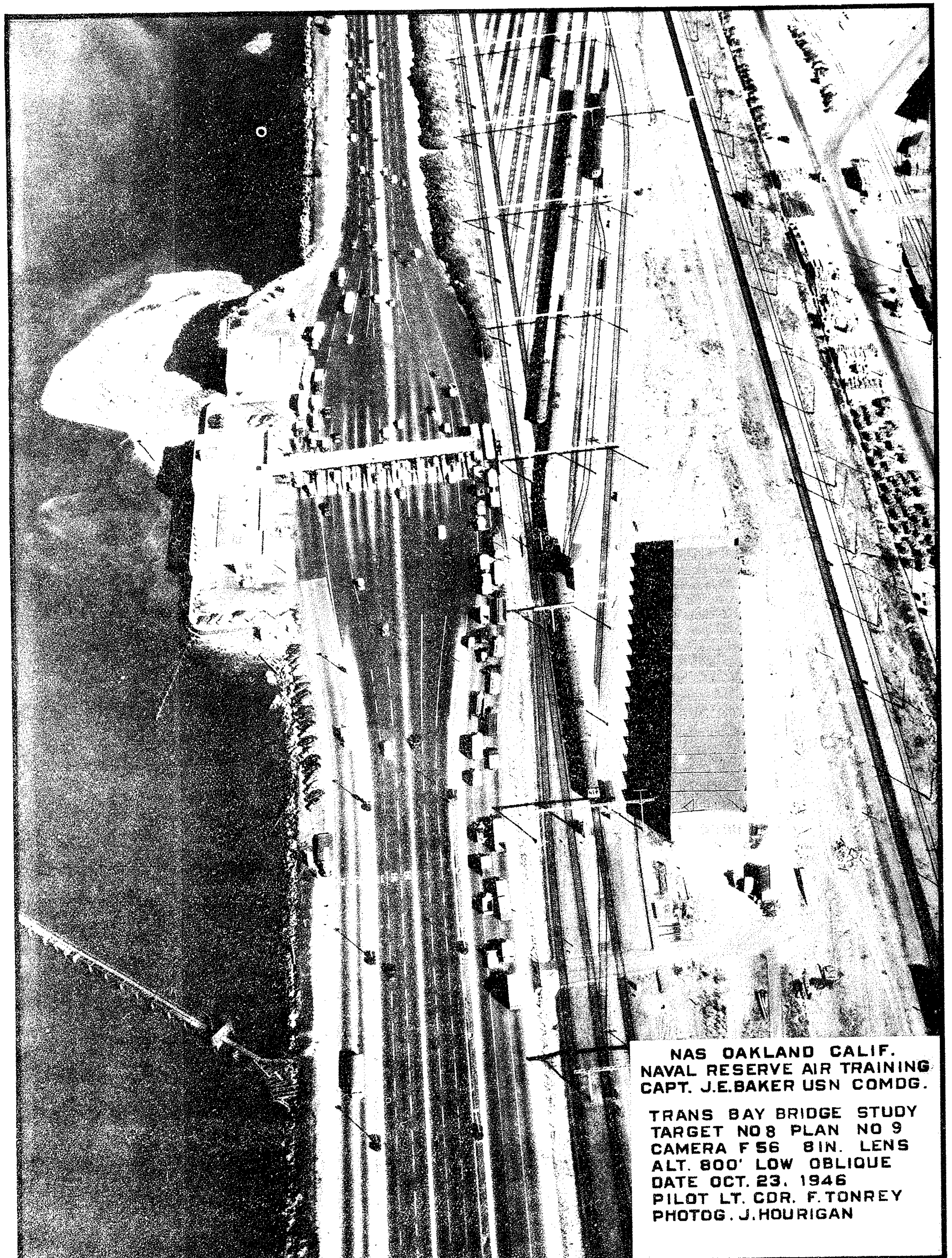
SAN FRANCISCO APPROACH 2572'
SAN FRANCISCO ANCHORAGE 1335'
WEST BAY SPANS 9441'
800' V.C.
200' V.C.
+1.02 %
+3.00%
Reinforced Concrete Viaduct
Steel Structure
El. 148.77
Sta. 43+00 E.V.C.
Sta. 44+94.00
El. 148.87
Sta. 48+00 B.V.C.
El. 152.89
Sta. 50+00 E.V.C.
El. 212.89 UD
El. 186.47 LD
40
50
60
70
377.96'
95.71'
388.95'
1171'
W1
W2
S.E. ANCHORAGE
℄ Bearing 49+66.38
ELEVATION
FOLSOM ST.
ESSEX
LANSING
FIRST ST.
FREMONT ST.
BEALE ST.
MAIN ST.
SPEAR ST.
STEUART ST.
EMBARCADERO
HARRISON ST.
BRYANT ST.
STERLING
RINCON
Δ 10°34'58.8"
R 3000'
T 277.85'
L 554.12'
Δ 5°47'50.9"
R 3000'
T 151.91'
L 303.56'
E.C. 42+31.73
B.C. 36+77.61
B.C. 45+41.13
E.C. 48+44.69
N. 40°20' 47.30" E.
Five Story Conc. Bldg. F.M. Co. & United Drug
Five story conc. bldg. Matson Line
PIER 22
PIER 24
PIER 26
Sta. 70+00 ℄ Pier No. W-2
325'
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
2 ND. STREET TO EMBARCADERO
LOCATION NO. 8
SCALE IN FEET
0 100 200 300
1946
P-1843-61



FREEWAY VIADUCT
SAN FRANCISCO APPROACH = 2572'
300' V.C.
-0.52%
200' V.C.
+3.60%
400' V.C.
+5.809%
800' V.C.
Reinforced concrete viaduct
El. 37.00 Sta. 286+00 B.V.C.
El. 36.22 Sta. 289+00 E.V.C.
El. 35.44 Sta. 290+50 B.V.C.
℄ Fourth St.
El. 38.52 Sta. 292+50 E.V.C.
℄ Third St.
El. 80.20 Sta. 28+00 B.V.C.
El. 99.02 Sta. 32+00 E.V.C.
℄ Second St.
El. 116.45 Sta. 35+00 B.V.C.
El. 143.77 Sta. 43+00 E.V.C.
14 @ 59'-7¾" = 835'
93'-4"
295+30 = 19+22.18
Line ①
12 @ 67'-11" = 815'
ELEVATION
FOURTH ST.
THIRD ST.
SECOND ST.
HARRISON ST.
BRYANT ST.
Two Story Concr. Bldg.
Three Story Concr. Bldg.
5 Story Rein. Concr. Bldg. Fleishhacker paper box Co.
5 Story Rein. Conc. & Br. Bldg. Fleishhacker Paper Box Co.
5 Story Rein. Conc. Bldg.
295+30 E.C. 19+22.18 POT.
R=500
R=1000
R=1200
R=5000
R=3000
LINE ②
N. 45° 07' 55.20" E.
ESSEX
LANSING
FIRST ST.
STERLING
RINCON
Δ 10°34'58.8" R 3000' T 277.85' L 554.12'
B.C. 36+77.61
E.C. 42+31.73
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
6TH STREET TO 2ND STREET
LOCATION NO. 8
SCALE IN FEET
0 100 200 300
1946
P-1843-63

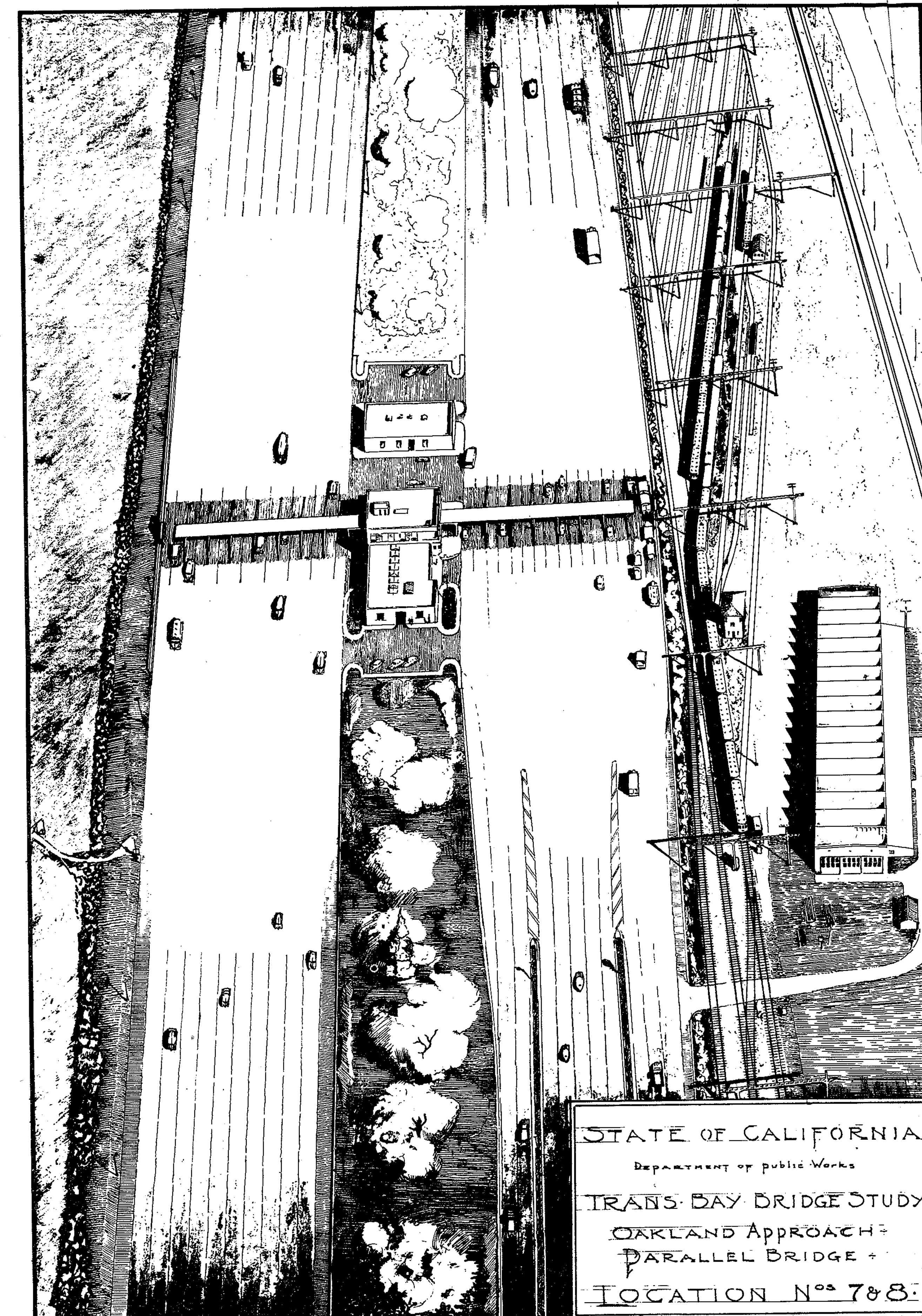

FREEWAY VIADUCT
SAN FRANCISCO APPROACH = 2572'
-0.3%
300' V.C.
Level
300' V.C.
-0.52%
200' V.C.
+3.60%
400' V.C.
Reinforced Concrete Viaduct
℄ Sixth St.
El. 37.45 Sta. 281+60 B.V.C.
℄ Fifth St.
El. 37.00 Sta. 284+60 E.V.C.
El. 37.00 Sta. 286+00 B.V.C.
El. 36.22 Sta. 289+00 E.V.C.
El. 35.44 Sta. 290+50 B.V.C.
℄ Fourth St.
El. 36.52 Sta. 292+50 E.V.C.
℄ Third St.
El. 80.20 Sta. 28+00 B.V.C.
El. 99.02 Sta. 32+00 E.V.C.
280
290
20
30
295+30 = 19+22.18
93'-4"
14 @ 59'-7¾" = 835'
93'-4"
14 @ 59'-7¾" = 835'
93'-4"
12 @ 67'-11" = 815'
93'-4'
12 @ 67'-11' = 815'
Line ①
ELEVATION
SIXTH ST.
FIFTH ST.
FOURTH ST.
THIRD ST.
HARRISON ST.
BRYANT ST.
Two Story Concr. Bldg.
R=500
R=1000
R=1200
R=5000
R=3000
R=3000
295+30 E.C. 19+22.18 POT.
LINE ①
LINE ②
N. 45° 07' 55.20" E.
N. 45° 07' 55.20" E.
280
290
280
280
5
5
20
30
PLAN
STATE OF
DEPARTMENT
TRANS-BAY
SAN FRANC
6TH STREET T
LOCAT
SCALE
1946
0
100



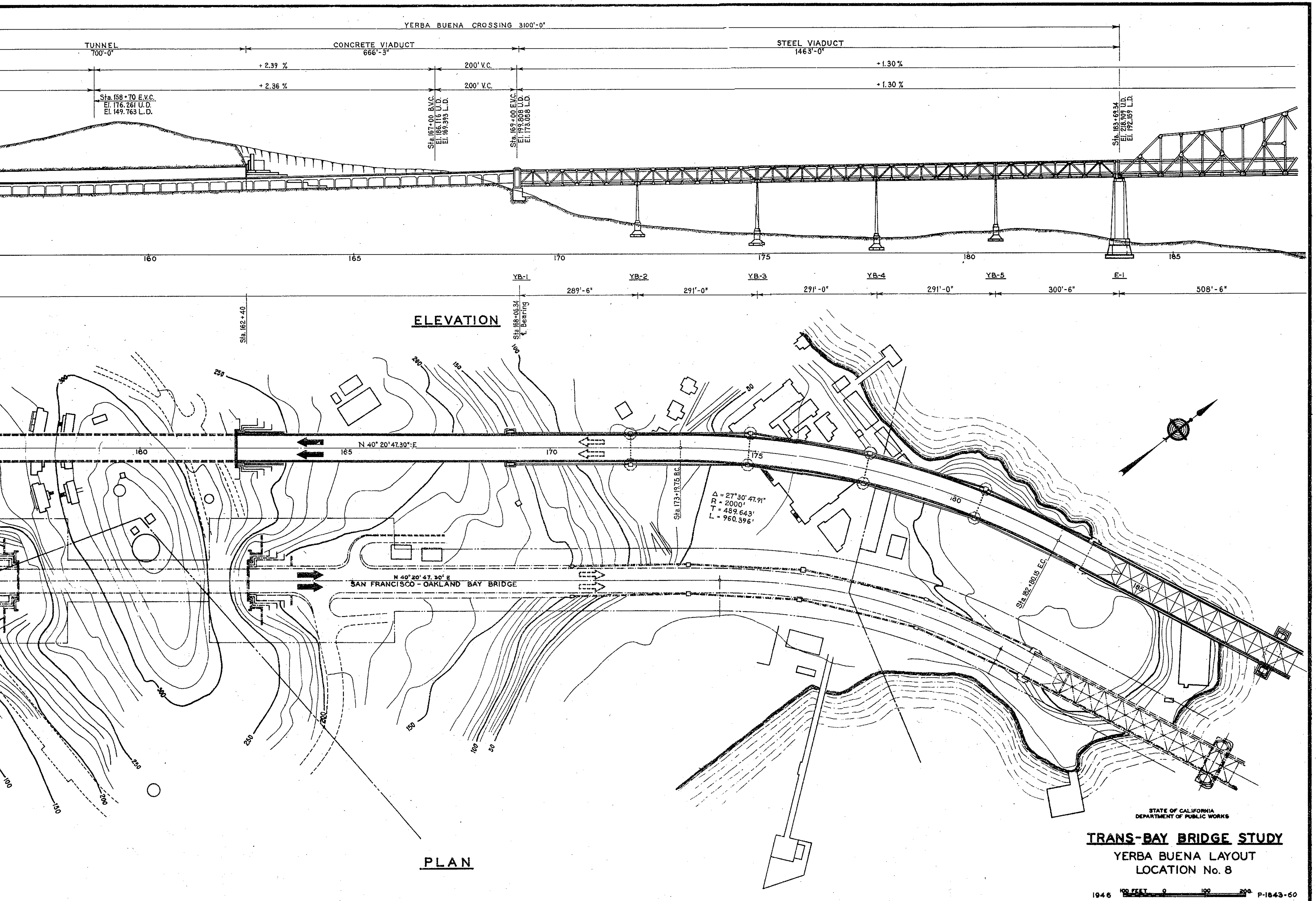


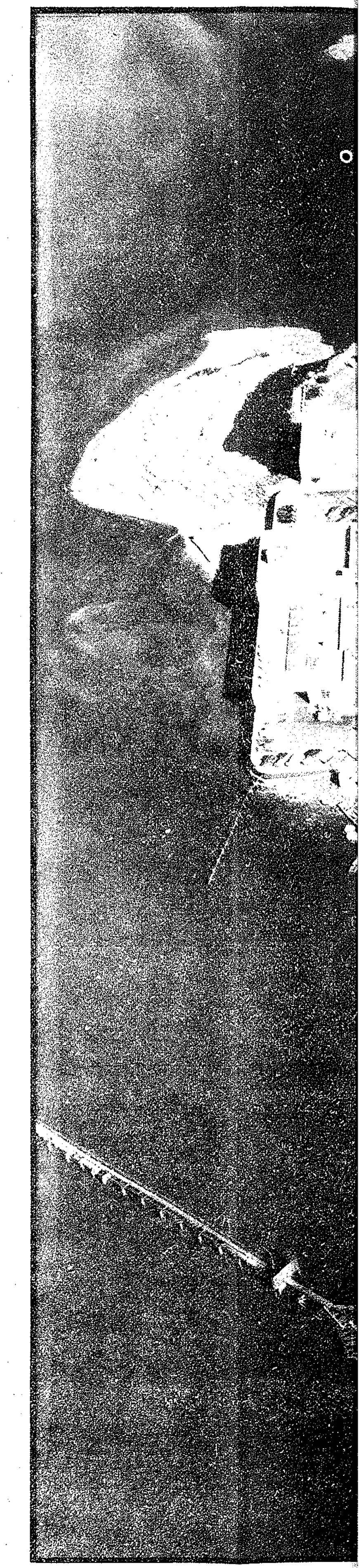
NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.

TRANS BAY BRIDGE STUDY
TARGET NO 8 PLAN NO 9
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23, 1946
PILOT LT. CDR. F. TONREY
PHOTOG. J. HOURIGAN



STATE OF CALIFORNIA
Department of Public Works
TRANS BAY BRIDGE STUDY
OAKLAND APPROACH
PARALLEL BRIDGE
LOCATION Nos 7 & 8


YERBA BUENA CROSSING 3100'-0"
TUNNEL
700'-0"
CONCRETE VIADUCT
666'-3"
STEEL VIADUCT
1463'-0"
+ 2.39 %
+ 2.36 %
200' V.C.
+ 1.30 %
Sta. 158 + 70 E.V.C.
El. 176.261 U.D.
El. 149.763 L.D.
Sta. 167 + 00 B.V.C.
El. 186.116 U.D.
El. 169.393 L.D.
Sta. 169 + 00 E.V.C.
El. 199.808 U.D.
El. 173.058 L.D.
Sta. 183 + 69.34
El. 218.909 U.D.
El. 192.159 L.D.
YB-1
YB-2
YB-3
YB-4
YB-5
E-1
289'-6"
291'-0"
291'-0"
291'-0"
300'-6"
508'-6"
ELEVATION
Sta. 162 + 40
Sta. 168 + 06.34
℄ Bearing
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
Sta. 173 + 19.75 B.C.
Δ = 27° 30' 47.91"
R = 2000'
T = 489.643'
L = 960.396'
Sta. 182 + 80.15 E.C.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 8
1946
P-1843-60



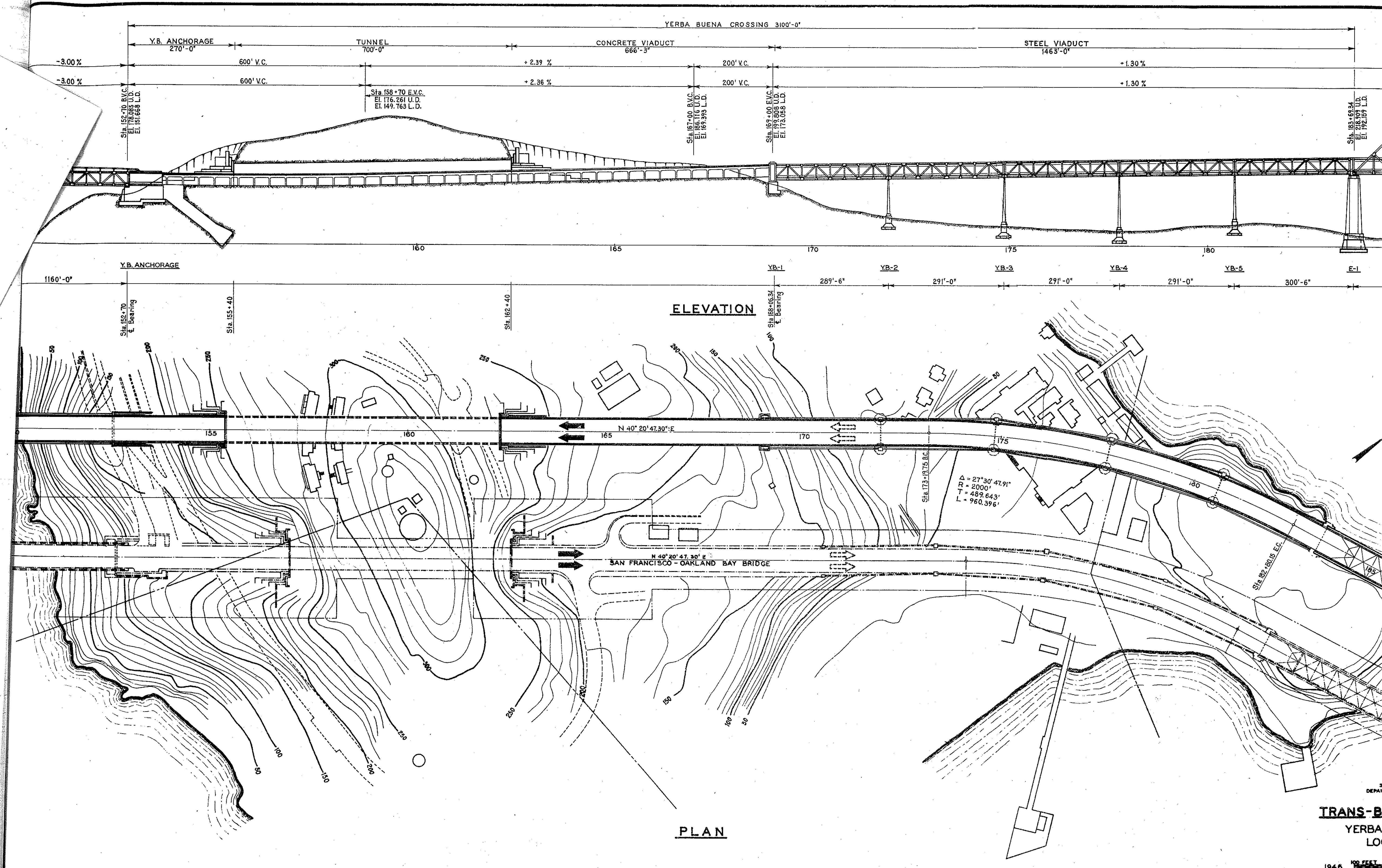
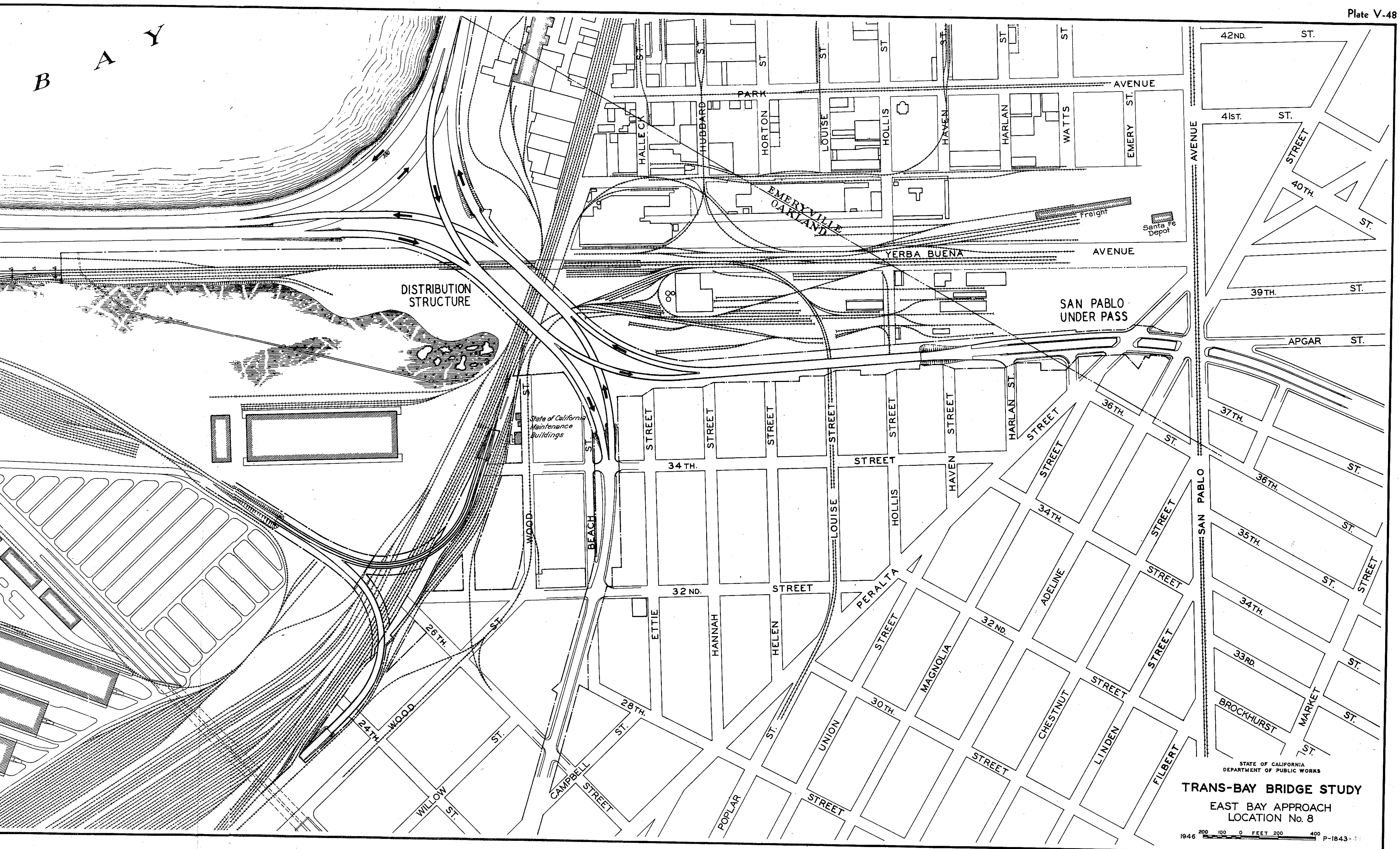


Plate V-44
YERBA BUENA CROSSING 3100'-0"
Y.B. ANCHORAGE 270'-0"
TUNNEL 700'-0"
CONCRETE VIADUCT 666'-3"
STEEL VIADUCT 1463'-0"
-3.00 %
600' V.C.
+ 2.39 %
+ 2.36 %
200' V.C.
+ 1.30 %
Sta. 152+70 B.V.C. El. 178.085 U.D. El. 151.668 L.D.
Sta. 158+70 E.V.C. El. 176.261 U.D. El. 149.763 L.D.
Sta. 167+00 B.V.C. El. 186.116 U.D. El. 169.393 L.D.
Sta. 169+00 E.V.C. El. 199.808 U.D. El. 173.058 L.D.
Sta. 183+69.34 El. 218.909 U.D. El. 192.159 L.D.
160
165
170
175
180
Y.B. ANCHORAGE
1160'-0"
Sta. 152+70 ℄ Bearing
Sta. 155+40
Sta. 162+40
Sta. 168+06.34 ℄ Bearing
YB-1
YB-2
YB-3
YB-4
YB-5
E-1
289'-6"
291'-0"
291'-0"
291'-0"
300'-6"
ELEVATION
N 40° 20' 47.30" E
Sta. 173+19.75 B.C.
Δ = 27° 30' 47.91"
R = 2000'
T = 489.643'
L = 960.396'
Sta. 182+80.15 E.C.
N 40° 20' 47.30" E
SAN FRANCISCO - OAKLAND BAY BRIDGE
PLAN
TRANS-BAY
YERBA B
LOCA
1946
100 FEET

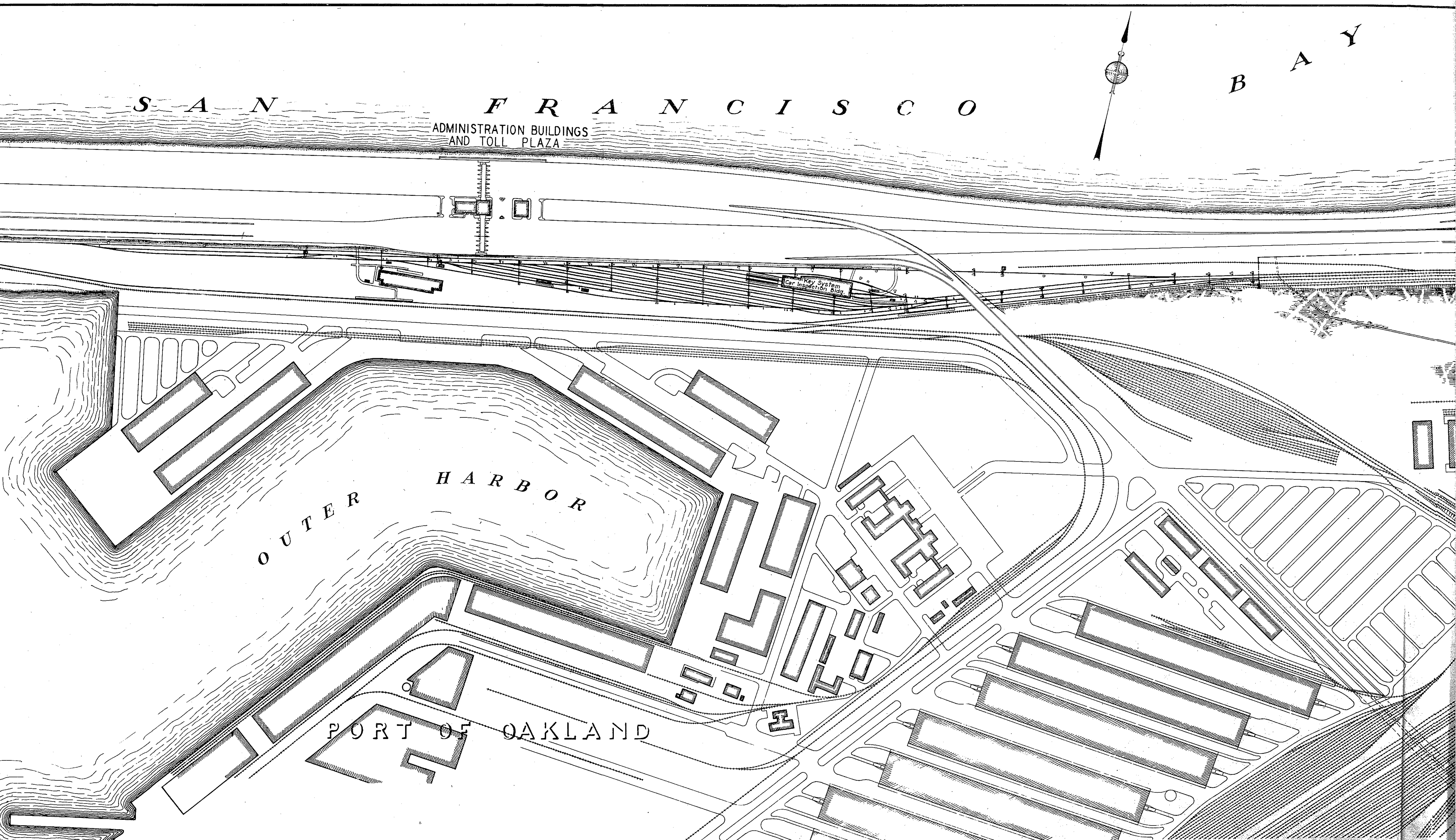


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

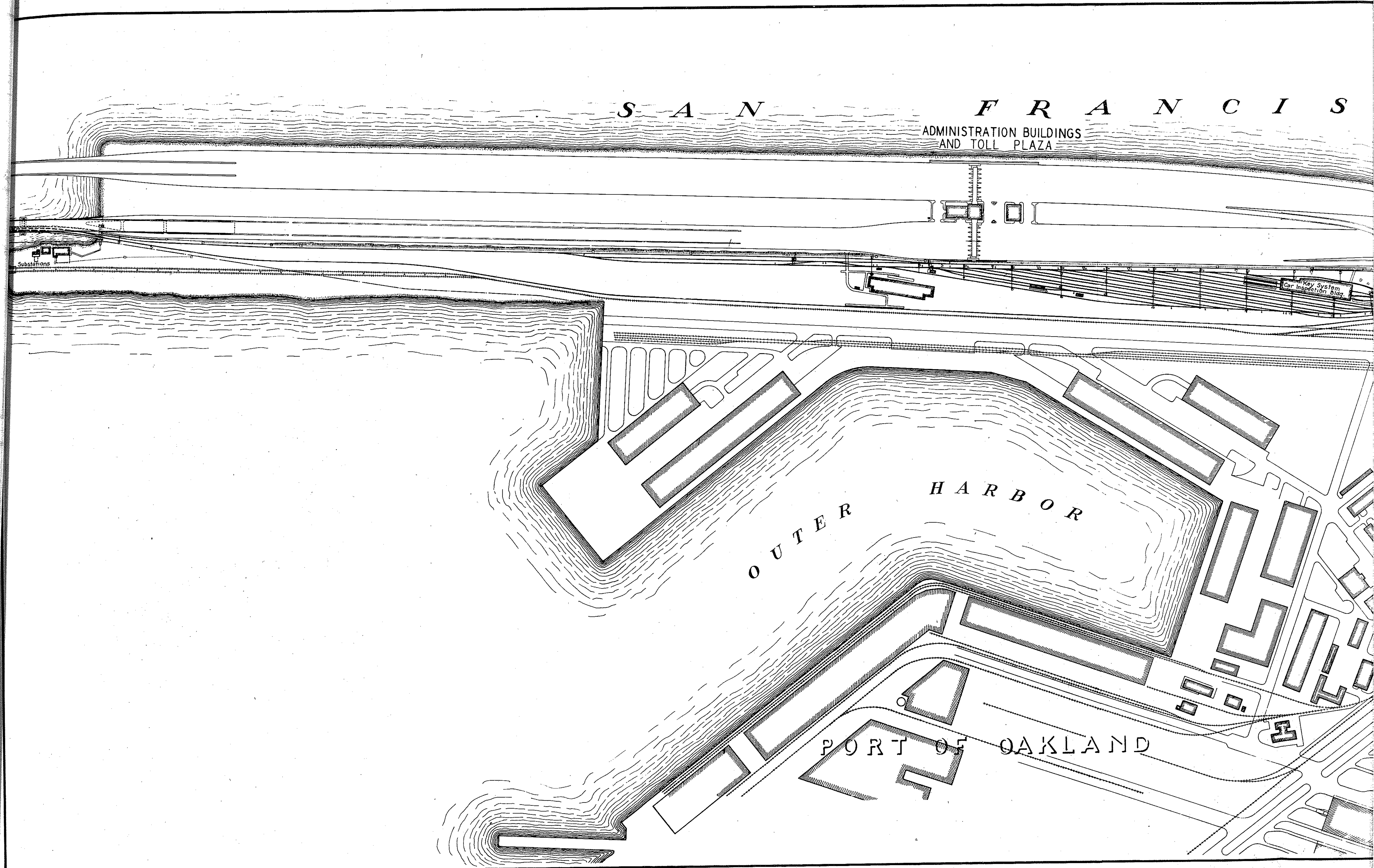
TRANS-BAY BRIDGE STUDY

EAST BAY APPROACH
LOCATION No. 8

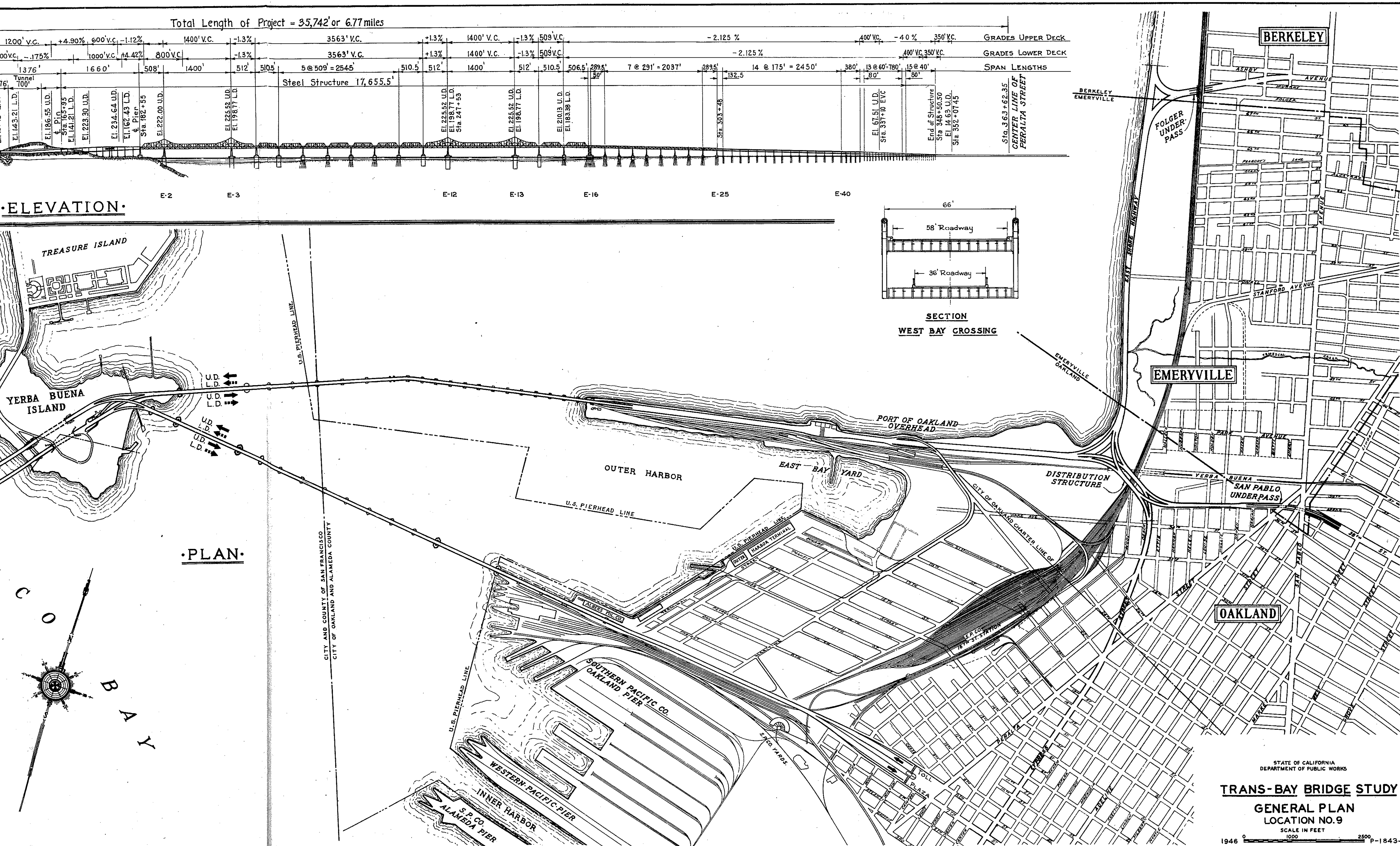
1946 — 200 100 0 FEET 200 400 — P-1843-

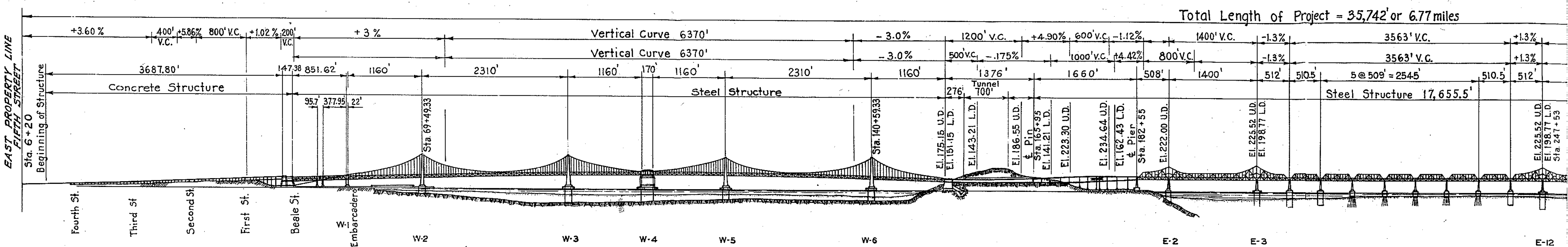


SAN FRANCISCO BAY
ADMINISTRATION BUILDINGS AND TOLL PLAZA
Key System Car Inspection Bldg.
OUTER HARBOR
PORT OF OAKLAND

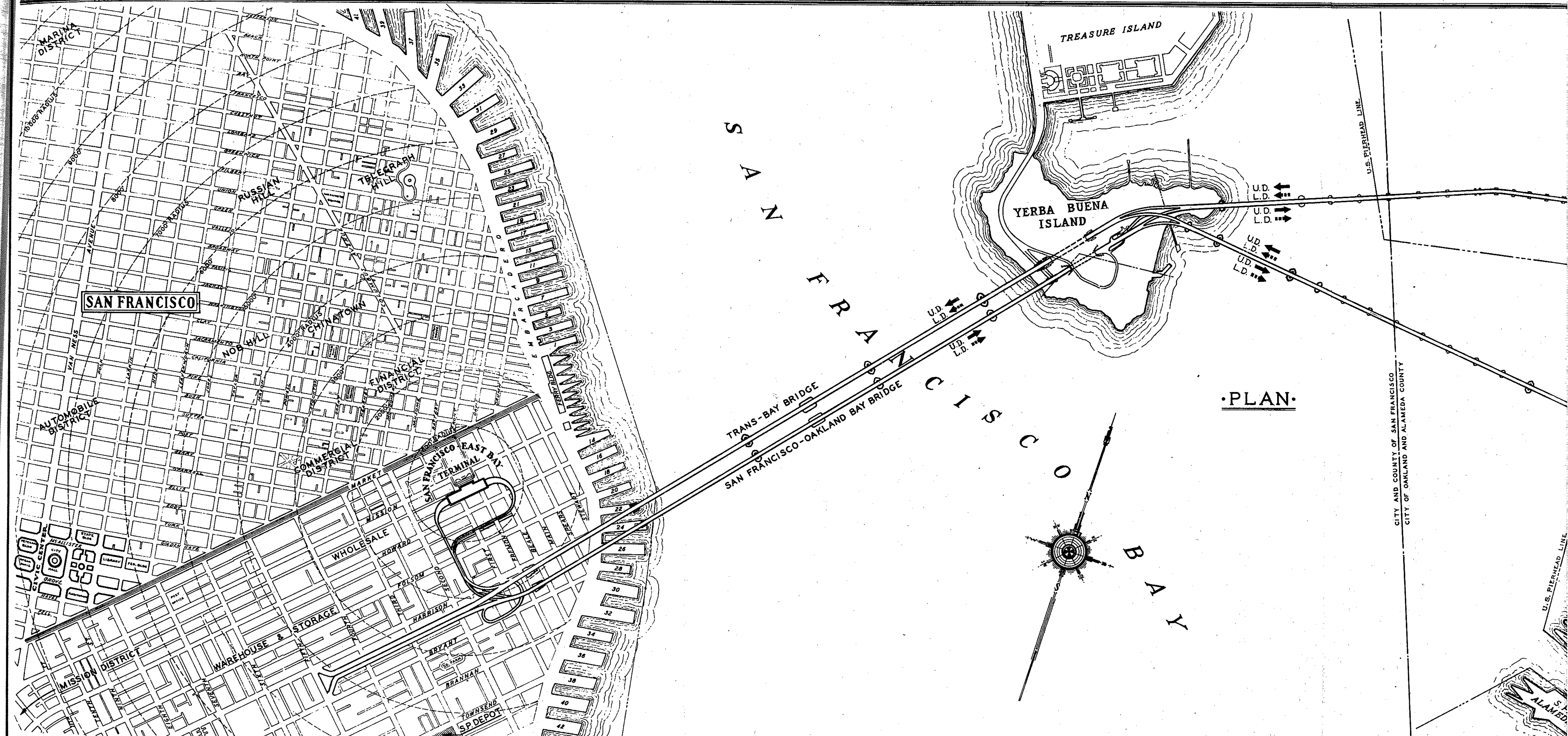


S A N   F R A N C I S
ADMINISTRATION BUILDINGS
AND TOLL PLAZA
Substations
Key System
Car Inspection Bldg.
OUTER HARBOR
PORT OF OAKLAND

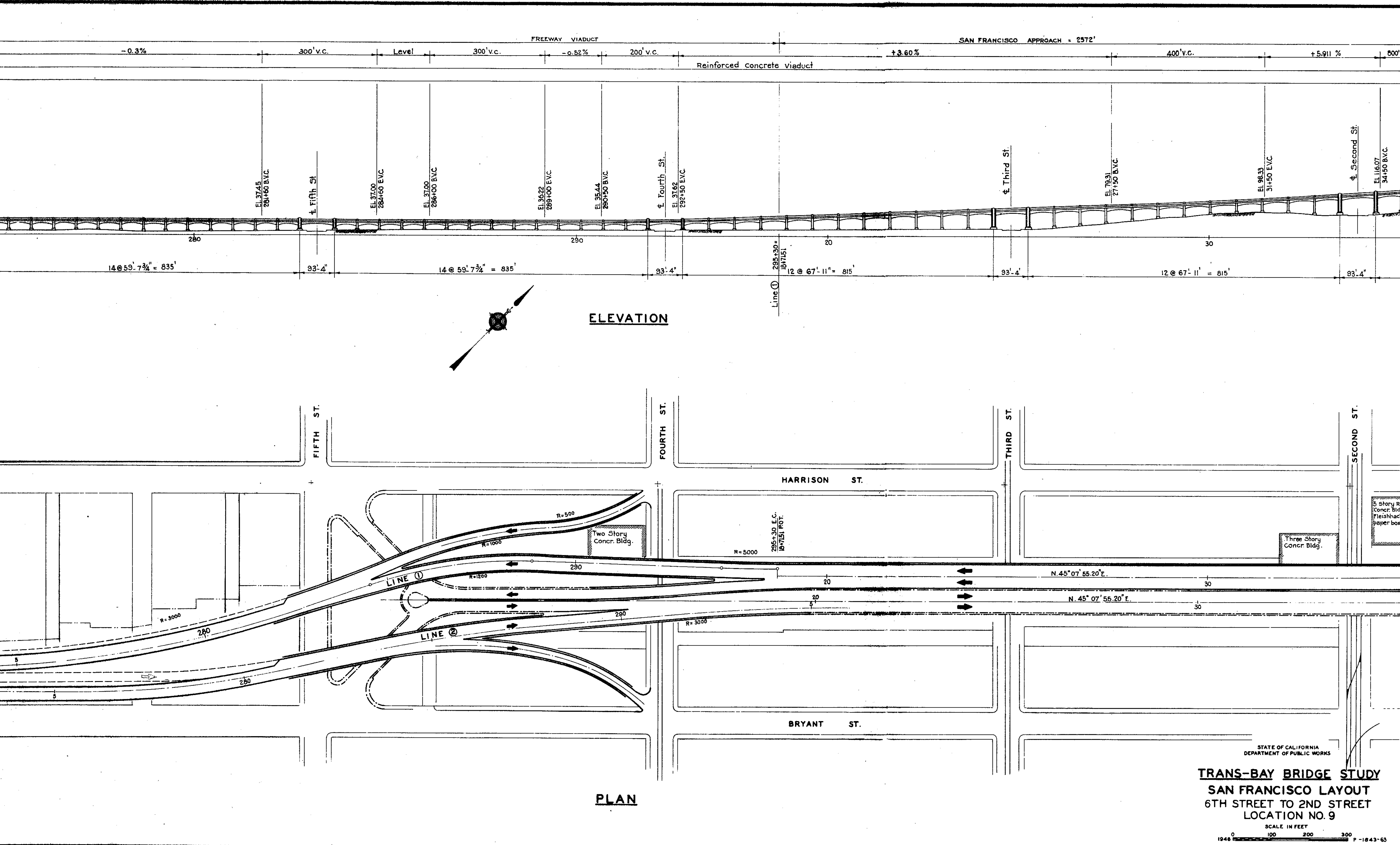

Total Length of Project = 35,742' or 6.77 miles
Grades Upper Deck
Grades Lower Deck
Span Lengths
Steel Structure 17,655.5'
-2.125 %
3563' V.C.
1400' V.C.
Center Line of Peralta Street
Sta. 363+62.35
End of Structure
·ELEVATION·
E-2
E-3
E-12
E-13
E-16
E-25
E-40
66'
58' Roadway
36' Roadway
SECTION
WEST BAY CROSSING
TREASURE ISLAND
YERBA BUENA ISLAND
U.D.
L.D.
U.S. PIERHEAD LINE
OUTER HARBOR
EAST BAY YARD
PORT OF OAKLAND OVERHEAD
DISTRIBUTION STRUCTURE
SAN PABLO UNDERPASS
FOLGER UNDER-PASS
BERKELEY
EMERYVILLE
OAKLAND
EAST SHORE HIGHWAY
CITY OF OAKLAND CHARTER LINE OF
CITY AND COUNTY OF SAN FRANCISCO
CITY OF OAKLAND AND ALAMEDA COUNTY
·PLAN·
BAY
SOUTHERN PACIFIC CO. OAKLAND PIER
WESTERN PACIFIC PIER
INNER HARBOR
S.P. CO. ALAMEDA PIER
S.P. CO. YARDS
TOLL PLAZA
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 9
SCALE IN FEET
1946
P-1843-

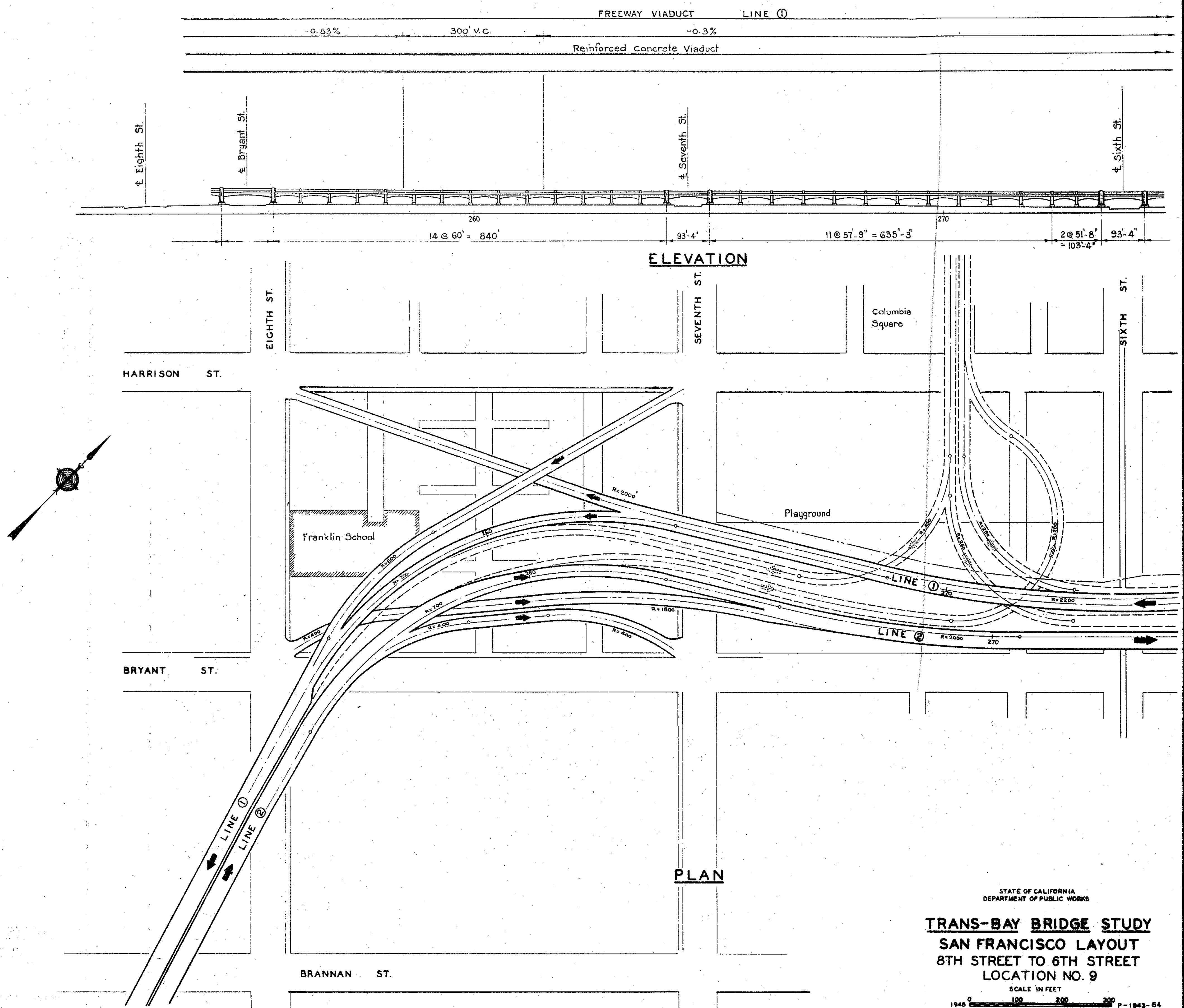


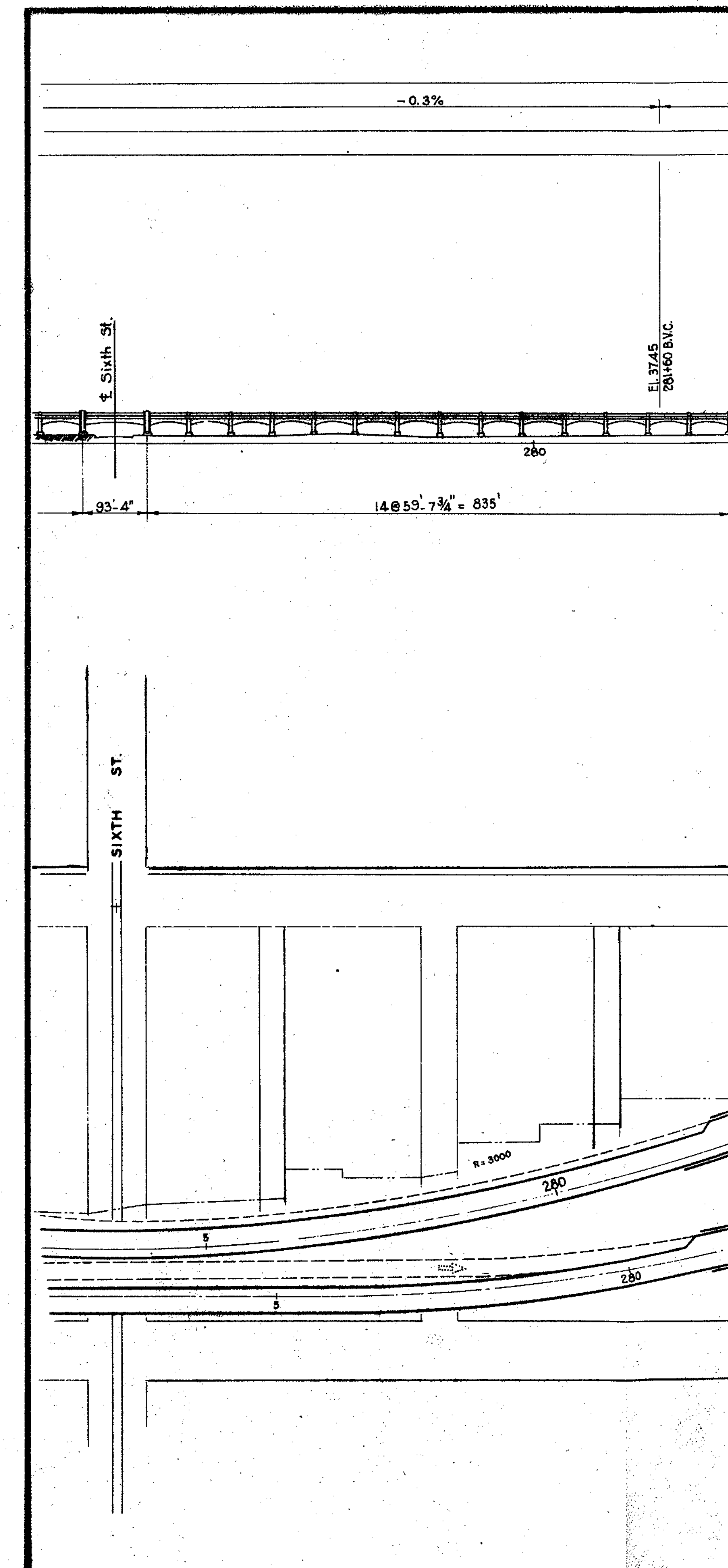
·ELEVATION·



·PLAN·


FREEWAY VIADUCT
SAN FRANCISCO APPROACH = 2572'
-0.3%
300' V.C.
Level
300' V.C.
-0.52%
200' V.C.
+3.60%
400' V.C.
+5.911 %
600' V.C.
Reinforced Concrete Viaduct
EL 37.45 281+60 B.V.C.
℄ Fifth St.
EL 37.00 284+60 E.V.C.
EL 37.00 286+00 B.V.C.
EL 36.22 289+00 E.V.C.
EL 35.44 290+50 B.V.C.
℄ Fourth St.
EL 37.62 292+50 E.V.C.
℄ Third St.
EL 79.31 27+50 B.V.C.
EL 98.33 31+50 E.V.C.
℄ Second St.
EL 116.07 34+50 B.V.C.
280
290
20
30
14 @ 59'-7¾" = 835'
93'-4"
14 @ 59'-7¾" = 835'
93'-4"
295+30 = 18+71.51
12 @ 67'-11" = 815'
93'-4'
12 @ 67'-11' = 815'
93'-4"
Line ①
ELEVATION
FIFTH ST.
FOURTH ST.
THIRD ST.
SECOND ST.
HARRISON ST.
BRYANT ST.
R=500
R=1000
R=1200
R=3000
R=5000
Two Story Concr. Bldg.
295+30 E.C. 18+71.51 P.O.T.
LINE ①
LINE ②
N. 45° 07' 55.20" E.
Three Story Concr. Bldg.
5 Story Rein. Concr. Bldg. Fleishhacker paper box Co.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
6TH STREET TO 2ND STREET
LOCATION NO. 9
SCALE IN FEET
0 100 200 300
1948
P-1843-63



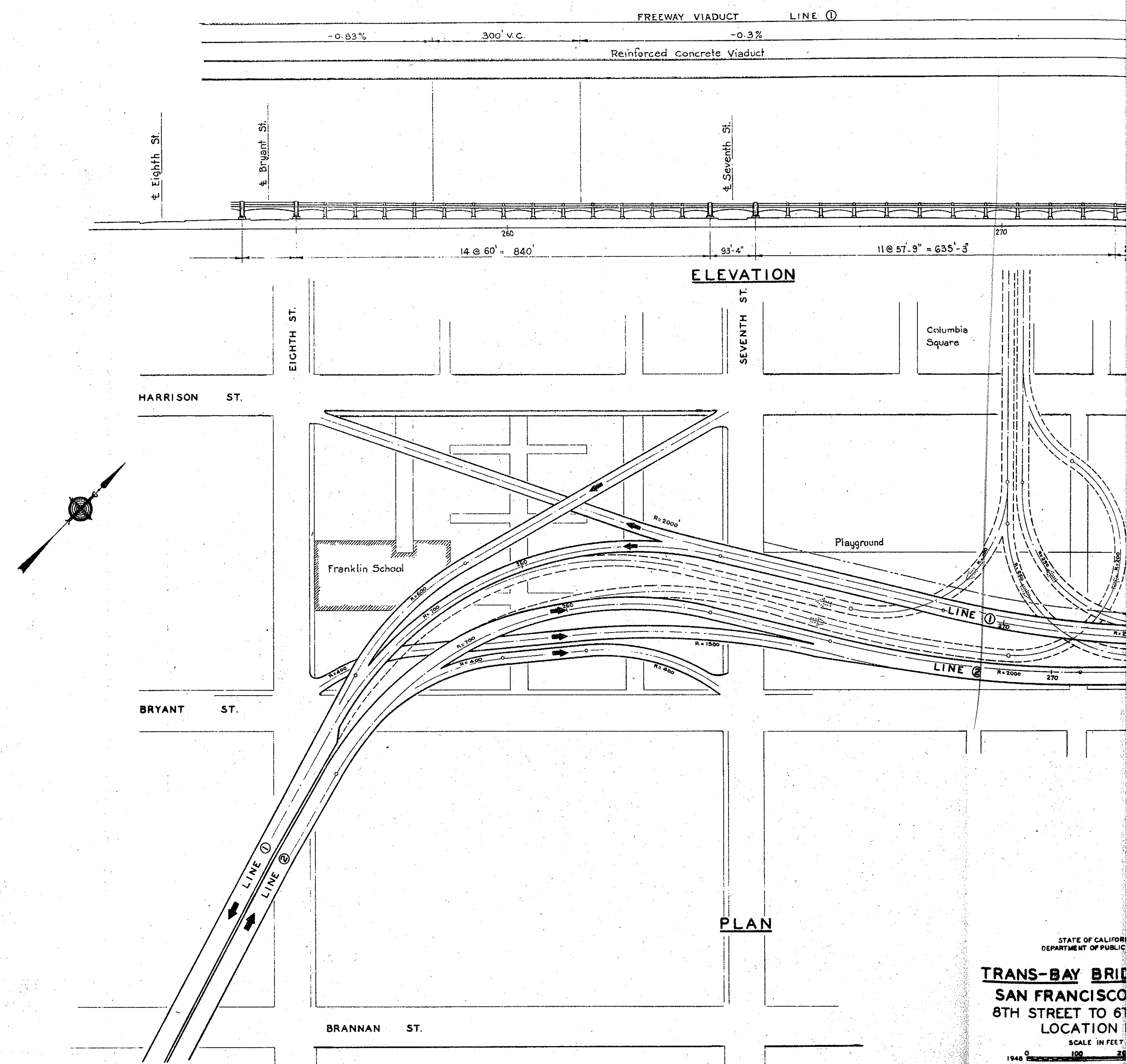


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

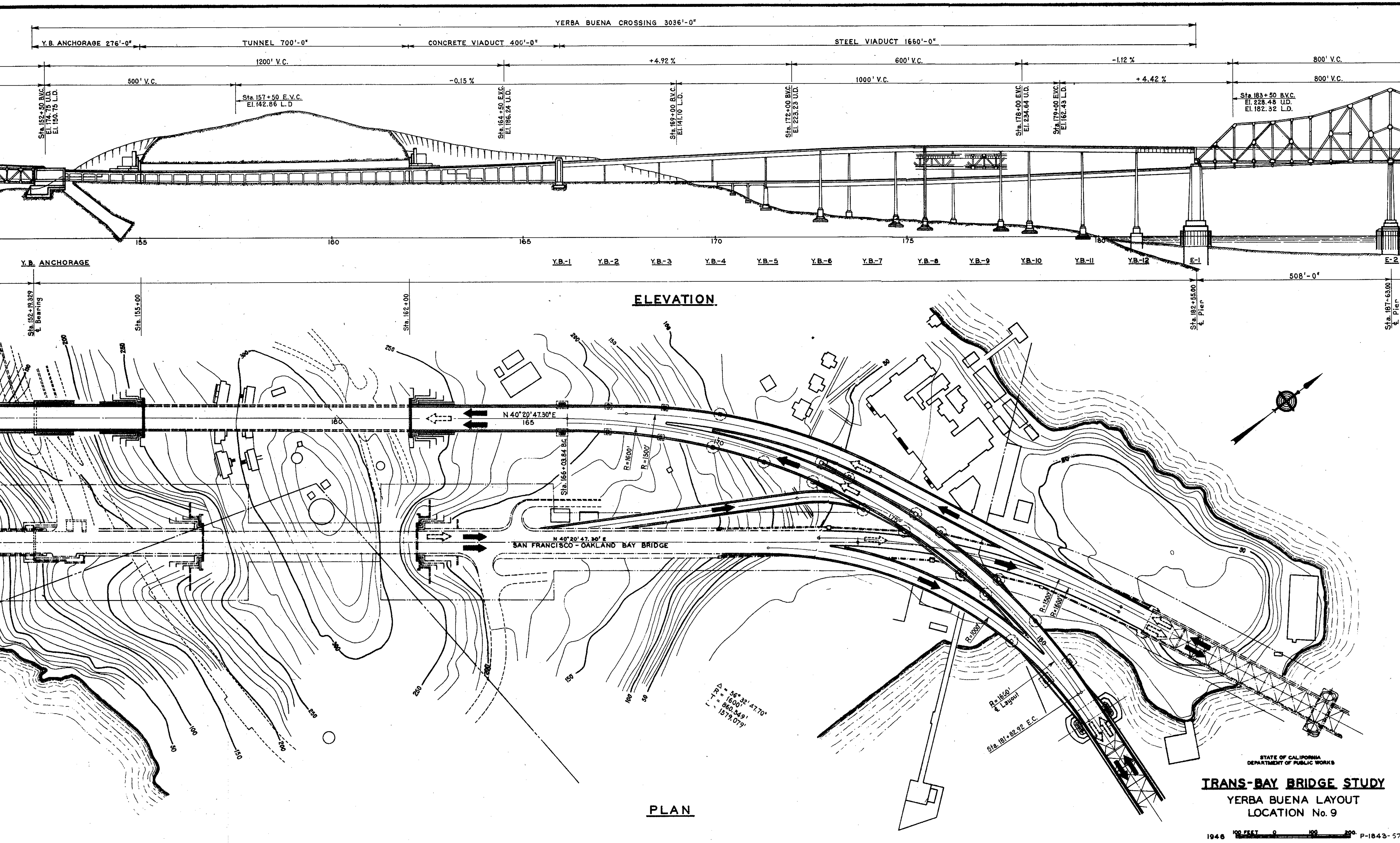
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
8TH STREET TO 6TH STREET
LOCATION NO. 9

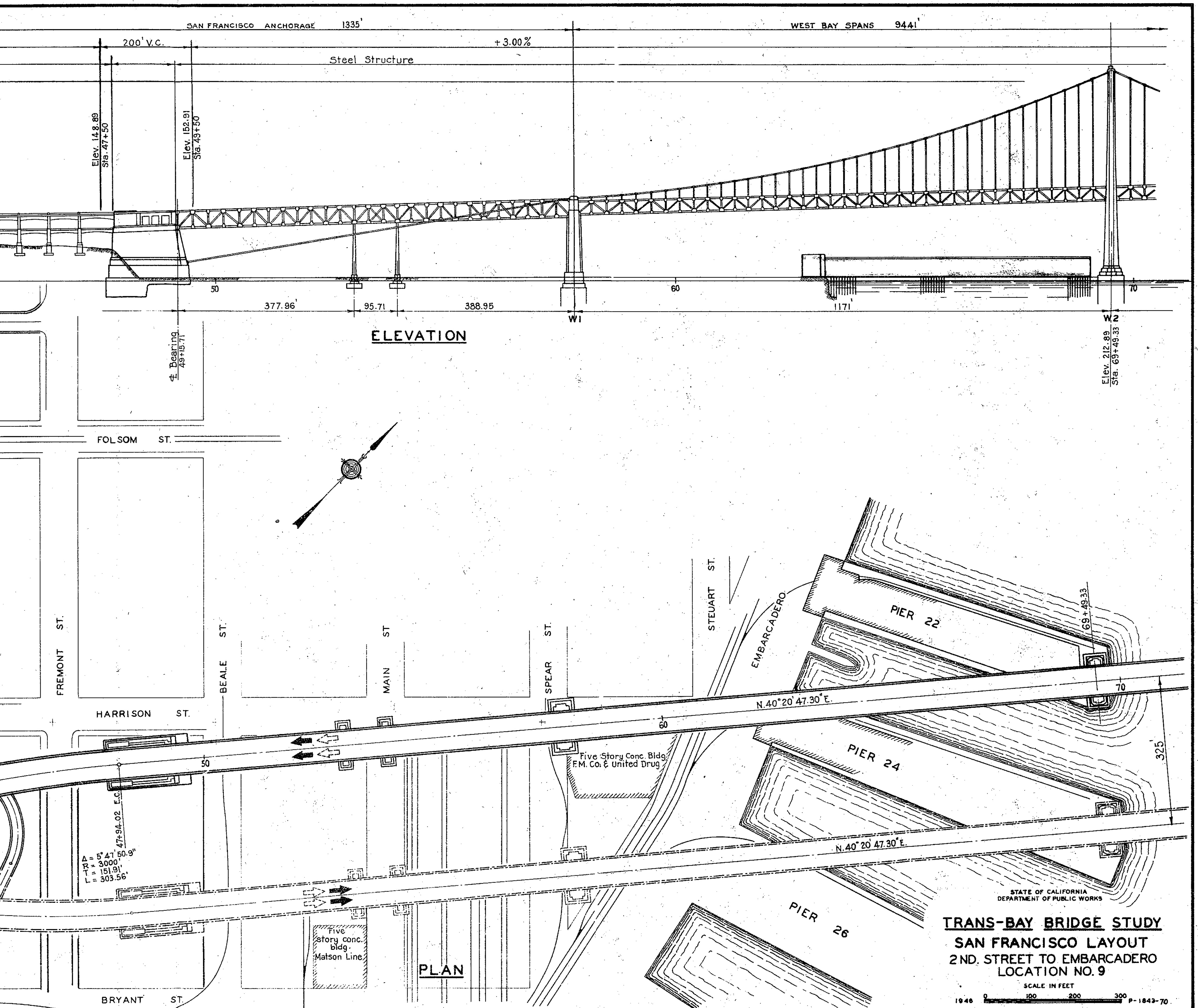
SCALE IN FEET
0 100 200 300

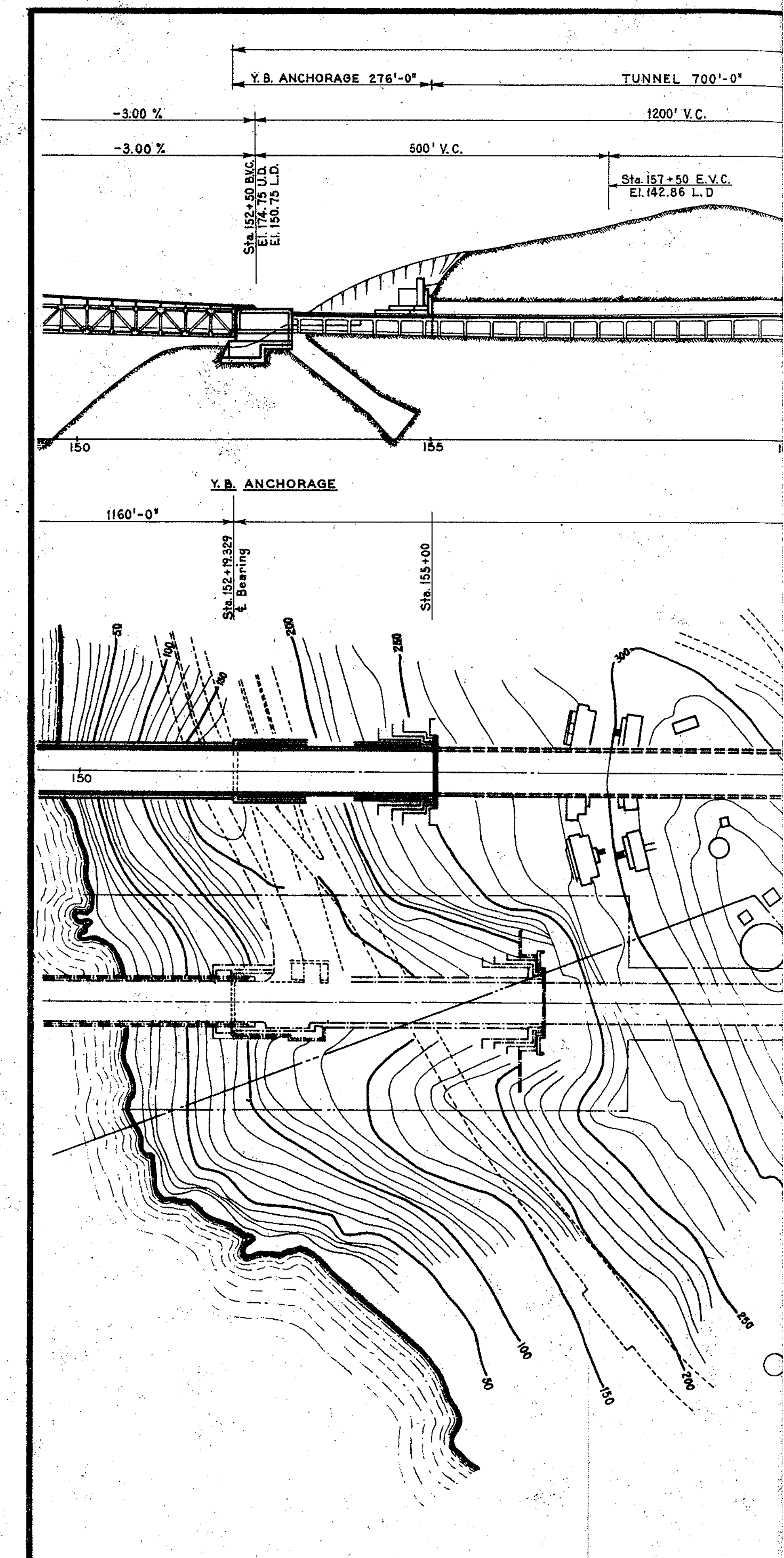
1946 P-1643-64

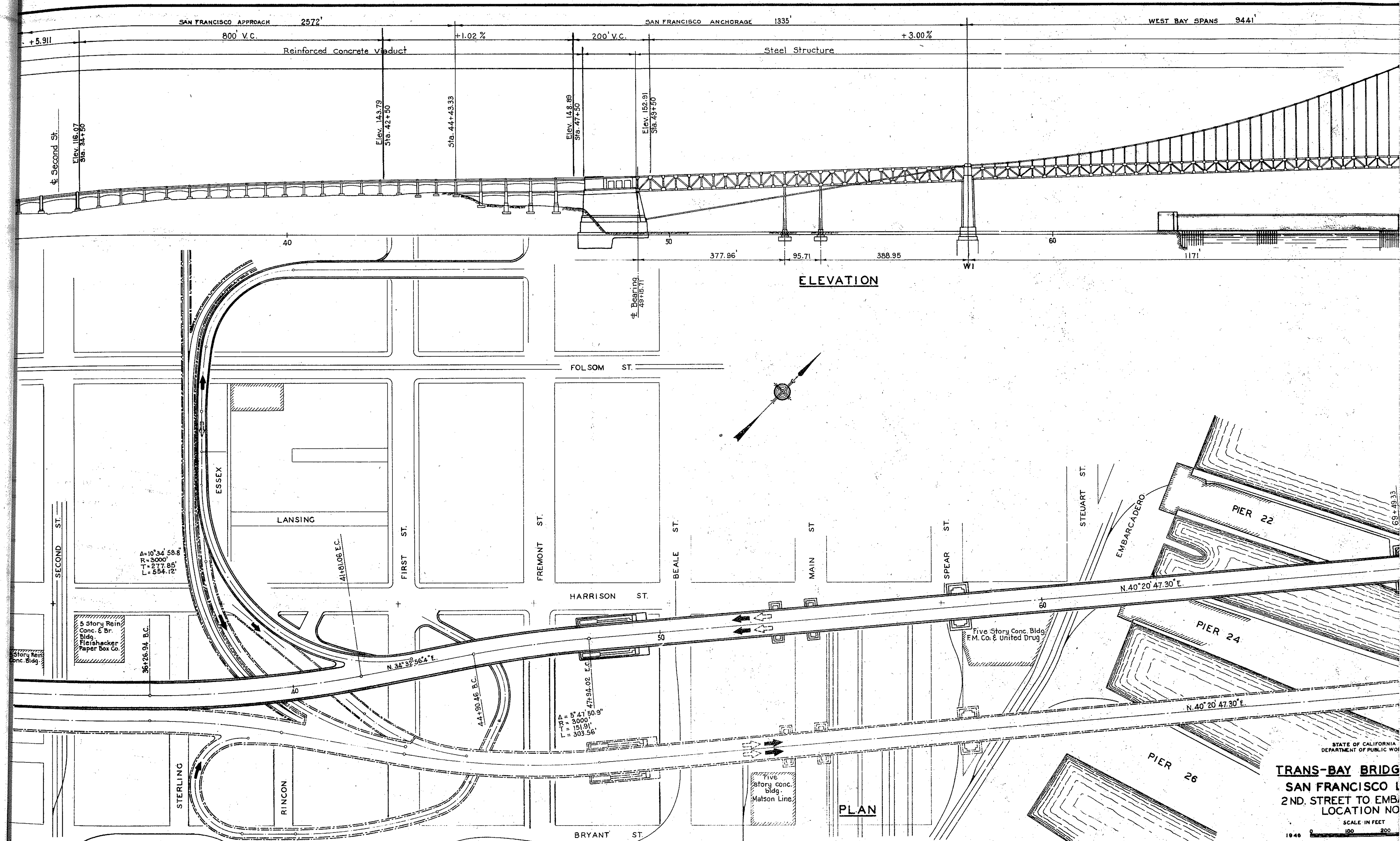


FREEWAY VIADUCT LINE ①
-0.83%
300' V.C.
-0.3%
Reinforced Concrete Viaduct
℄ Eighth St.
℄ Bryant St.
℄ Seventh St.
260
270
14 @ 60' = 840'
93'-4"
11 @ 57'-9" = 635'-3"
ELEVATION
EIGHTH ST.
SEVENTH ST.
Columbia Square
HARRISON ST.
Franklin School
Playground
LINE ①
LINE ②
BRYANT ST.
PLAN
BRANNAN ST.
TRANS-BAY BRID
SAN FRANCISCO
8TH STREET TO 6T
LOCATION

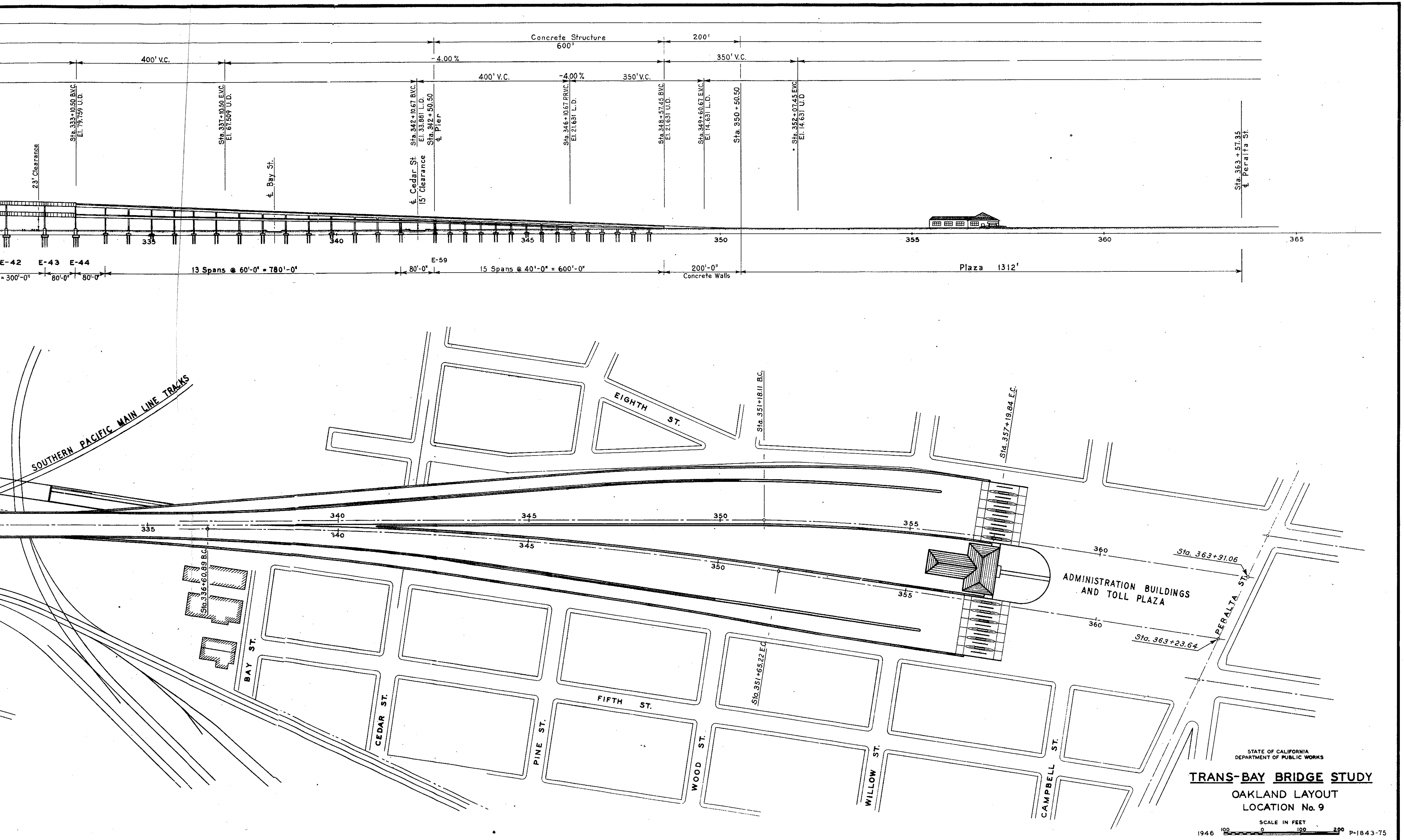

YERBA BUENA CROSSING 3036'-0"
Y.B. ANCHORAGE 276'-0"
TUNNEL 700'-0"
CONCRETE VIADUCT 400'-0"
STEEL VIADUCT 1660'-0"
1200' V.C.
+4.92 %
600' V.C.
-1.12 %
800' V.C.
500' V.C.
-0.15 %
1000' V.C.
+4.42 %
800' V.C.
Sta. 152+50 B.V.C. El. 174.75 U.D. El. 150.75 L.D.
Sta. 157+50 E.V.C. El. 142.86 L.D.
Sta. 164+50 E.V.C. El. 186.24 U.D.
Sta. 169+00 B.V.C. El. 141.10 L.D.
Sta. 172+00 B.V.C. El. 223.23 U.D.
Sta. 178+00 E.V.C. El. 234.64 U.D.
Sta. 179+00 E.V.C. El. 162.43 L.D.
Sta. 183+50 B.V.C. El. 228.48 U.D. El. 182.32 L.D.
155
160
165
170
175
180
Y.B. ANCHORAGE
Y.B.-1
Y.B.-2
Y.B.-3
Y.B.-4
Y.B.-5
Y.B.-6
Y.B.-7
Y.B.-8
Y.B.-9
Y.B.-10
Y.B.-11
Y.B.-12
E-1
E-2
508'-0"
Sta. 152+19.329 ℄ Bearing
Sta. 155+00
Sta. 162+00
ELEVATION
Sta. 182+55.00 ℄ Pier
Sta. 187+63.00 ℄ Pier
N 40°20'47.30"E
165
160
170
175
180
Sta. 166+03.84 B.C.
R=1600'
R=1500'
N 40°20'47.30"E
SAN FRANCISCO - OAKLAND BAY BRIDGE
R=1500'
R=1600'
R=1000'
R=1650' ℄ Layout
Sta. 181+82.92 E.C.
Δ = 56°32'47.70"
R = 1600'
T = 860.549'
L = 1579.079'
PLAN
STATE OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
YERBA BUENA LAYOUT
LOCATION No. 9
1946
100 FEET 0 100 200
P-1843-57


SAN FRANCISCO ANCHORAGE 1335'
WEST BAY SPANS 9441'
200' V.C.
+3.00%
Steel Structure
Elev. 148.89
Sta. 47+50
Elev. 152.91
Sta. 49+50
377.96'
95.71
388.95
1171'
W1
W2
ELEVATION
℄ Bearing 49+15.71
Elev. 212.89
Sta. 69+49.33
FOLSOM ST.
HARRISON ST.
BRYANT ST.
FREMONT ST.
BEALE ST.
MAIN ST.
SPEAR ST.
STEUART ST.
EMBARCADERO
PIER 22
PIER 24
PIER 26
69+49.33
N.40°20'47.30"E.
325
Five Story Conc. Bldg. F.M. Co. & United Drug
Five story conc. bldg. Matson Line
47+94.02 E.C.
Δ = 5°47'50.9"
R = 3000'
T = 151.91'
L = 303.56'
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
2ND. STREET TO EMBARCADERO
LOCATION NO. 9
SCALE IN FEET
1946
P-1843-70


Y. B. ANCHORAGE 276'-0"
TUNNEL 700'-0"
-3.00 %
1200' V.C.
500' V.C.
Sta. 152+50 B.V.C.
El. 174.75 U.D.
El. 150.75 L.D.
Sta. 157+50 E.V.C.
El. 142.86 L.D.
150
155
Y. B. ANCHORAGE
1160'-0"
Sta. 152+19.329
℄ Bearing
Sta. 155+00

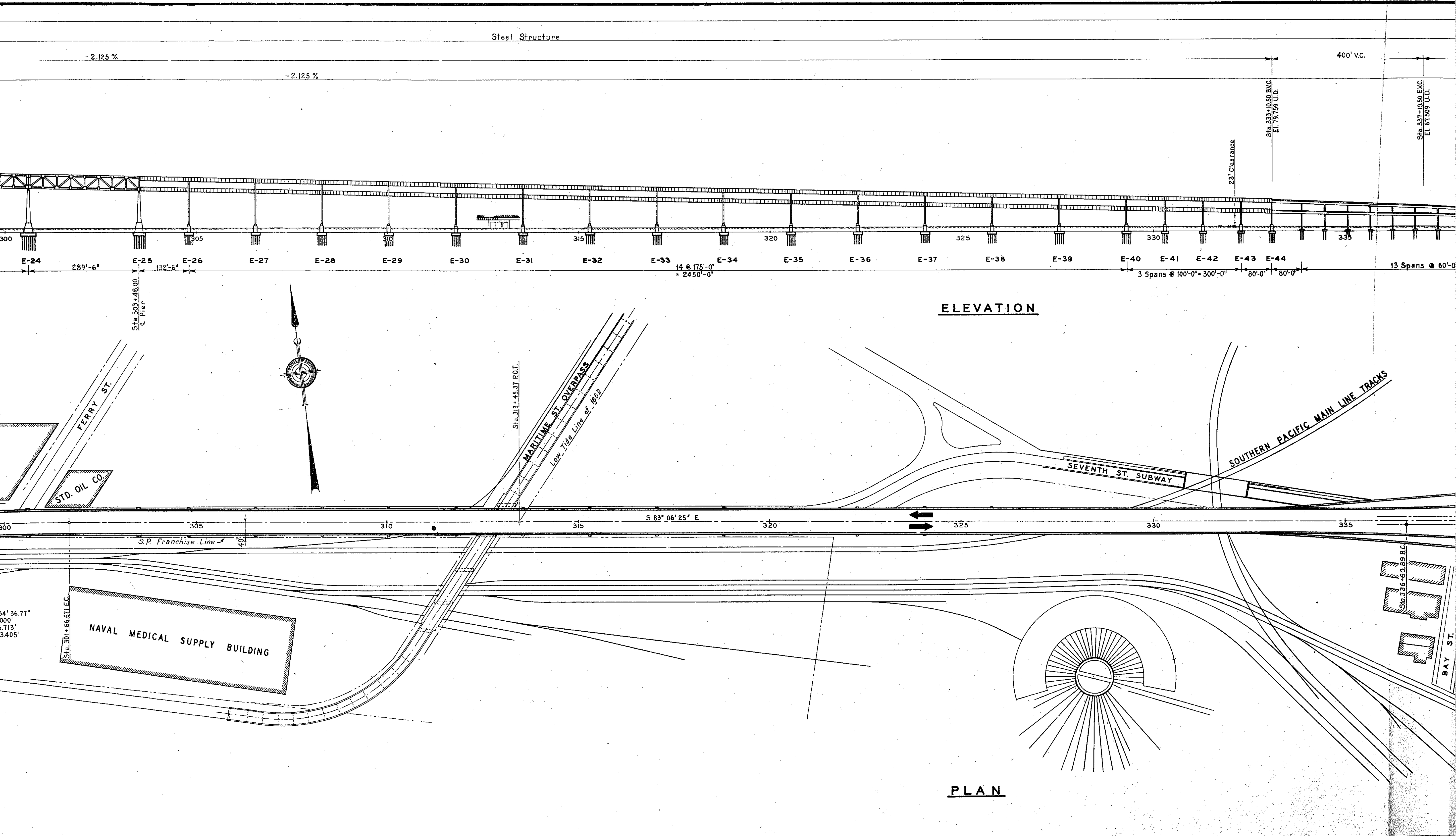


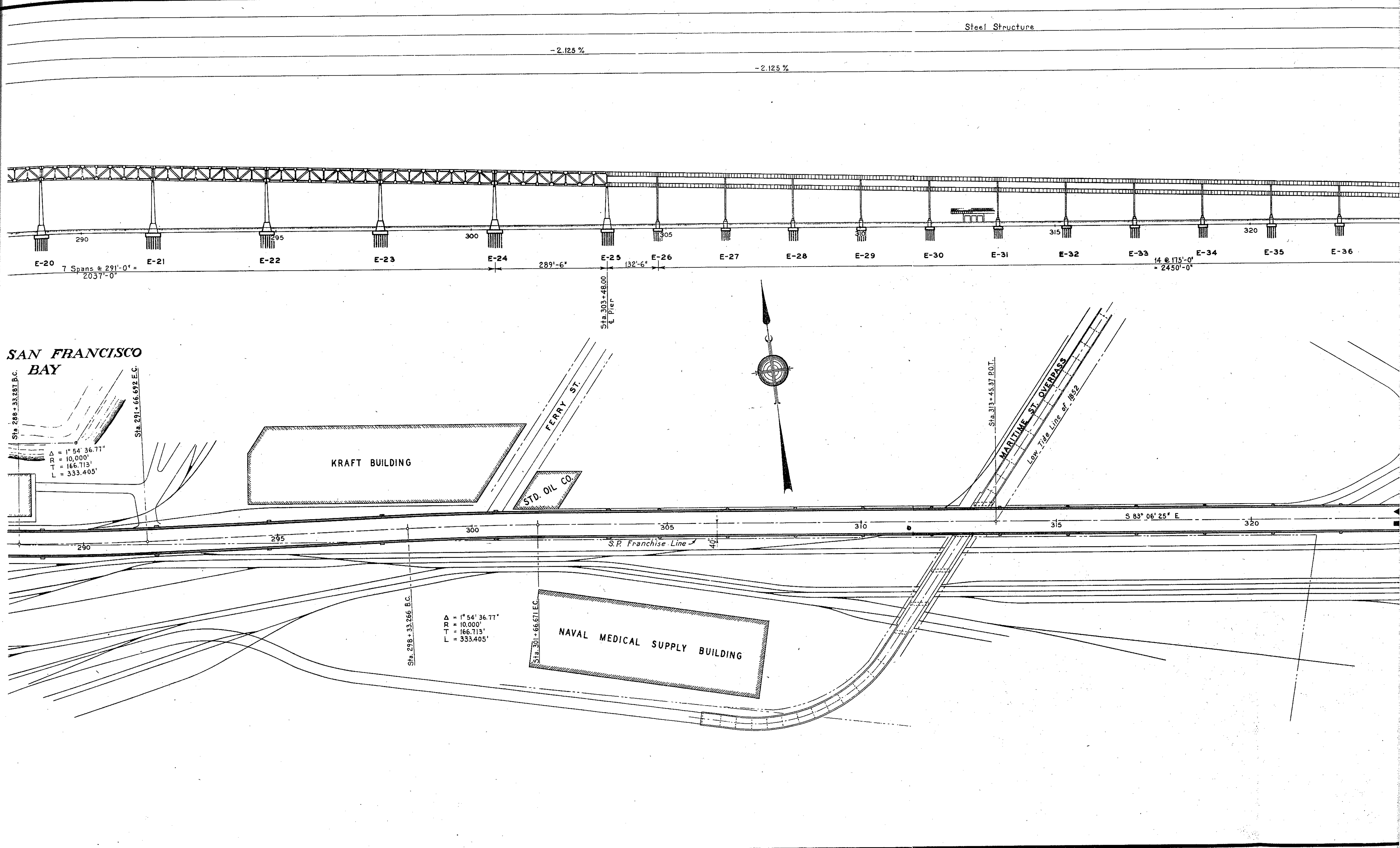
SAN FRANCISCO APPROACH 2572'
SAN FRANCISCO ANCHORAGE 1335'
WEST BAY SPANS 9441'
+5.911
800' V.C.
+1.02 %
200' V.C.
+3.00 %
Reinforced Concrete Viaduct
Steel Structure
℄ Second St.
Elev. 116.07
Sta. 34+50
Elev. 143.79
Sta. 42+50
Sta. 44+43.33
Elev. 148.89
Sta. 47+50
Elev. 152.91
Sta. 49+50
40
50
60
377.96'
95.71
388.95
W1
1171'
℄ Bearing
49+15.71
ELEVATION
FOLSOM ST.
ESSEX
LANSING
SECOND ST.
FIRST ST.
FREMONT ST.
BEALE ST.
MAIN ST.
SPEAR ST.
STEUART ST.
EMBARCADERO
HARRISON ST.
BRYANT ST.
STERLING
RINCON
PIER 22
PIER 24
PIER 26
Δ=10°34' 58.8"
R=3000'
T=277.85'
L=554.12'
41+81.06 E.C.
36+26.94 B.C.
44+90.46 B.C.
47+94.02 E.C.
Δ = 5°47' 50.9"
R = 3000'
T = 151.91'
L = 303.56'
N. 34°32' 56.4" E.
N. 40°20' 47.30" E.
69+49.33
5 Story Rein. Conc. & Br. Bldg. Fleishacker Paper Box Co.
5 Story Rein. Conc. Bldg.
Five Story Conc. Bldg. F.M. Co. & United Drug
Five story conc. bldg. Matson Line
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WO
TRANS-BAY BRIDG
SAN FRANCISCO L
2ND. STREET TO EMB
LOCATION NO
SCALE IN FEET
100
200
1946



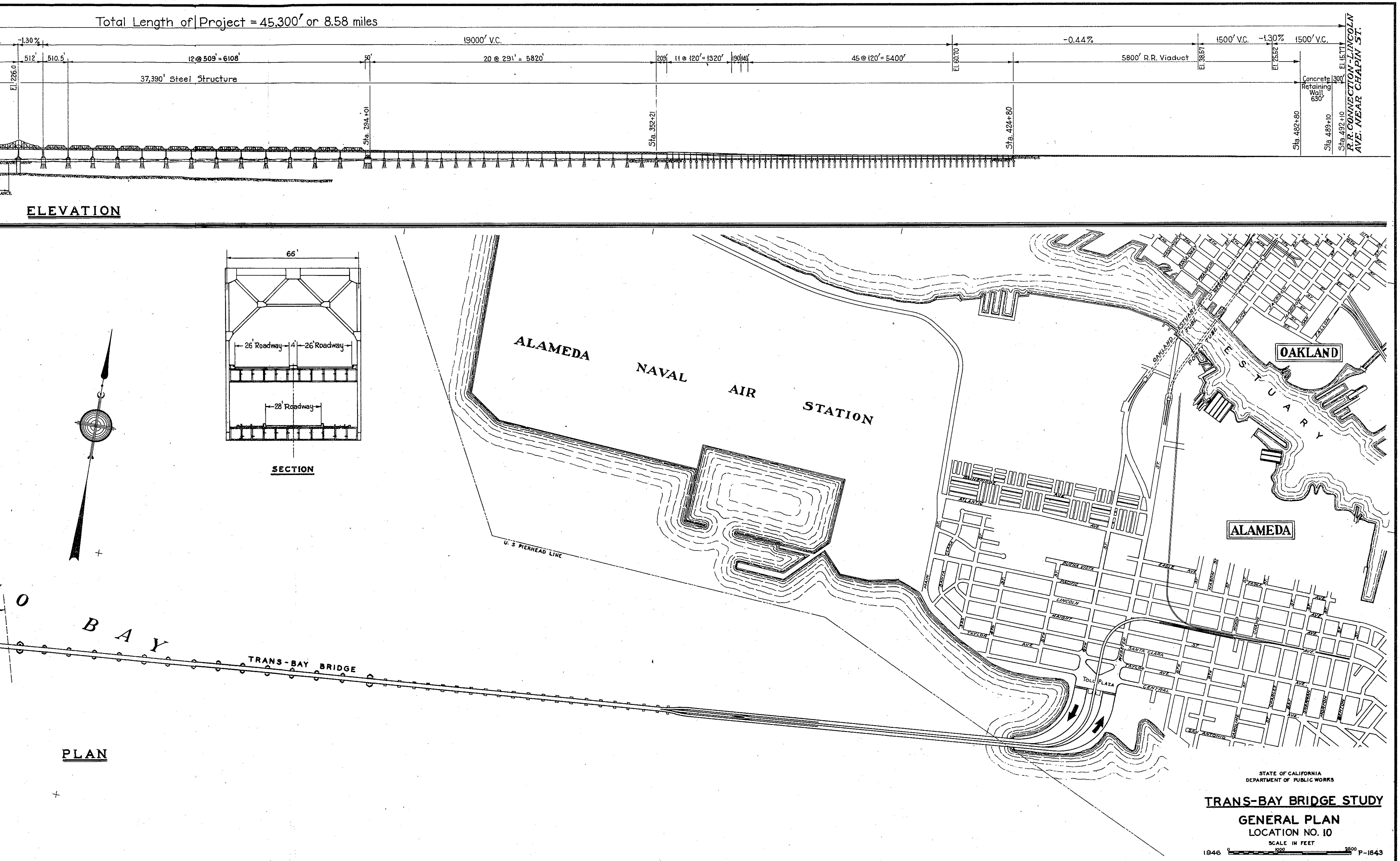
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

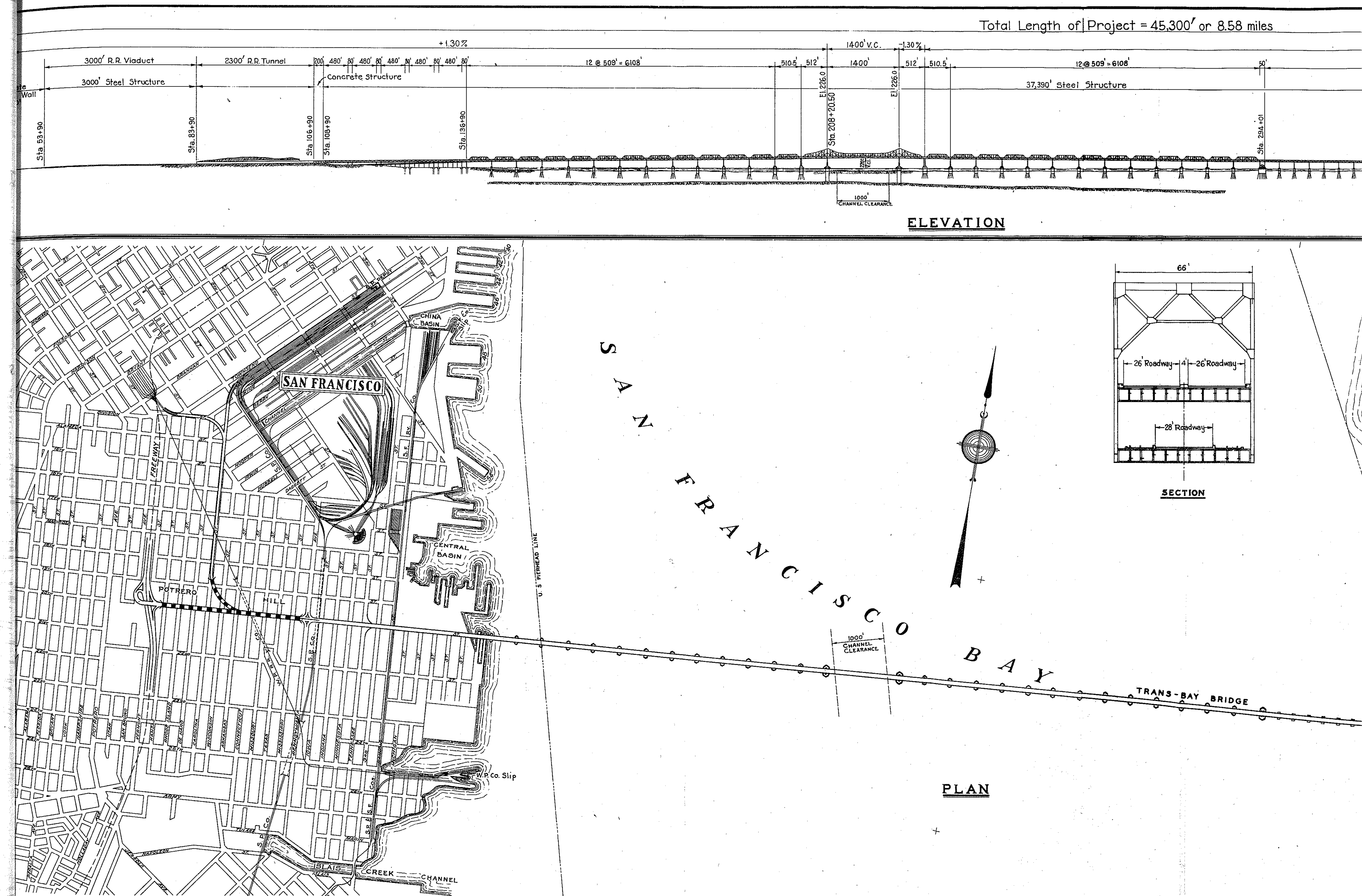
TRANS-BAY BRIDGE STUDY
OAKLAND LAYOUT
LOCATION No. 9

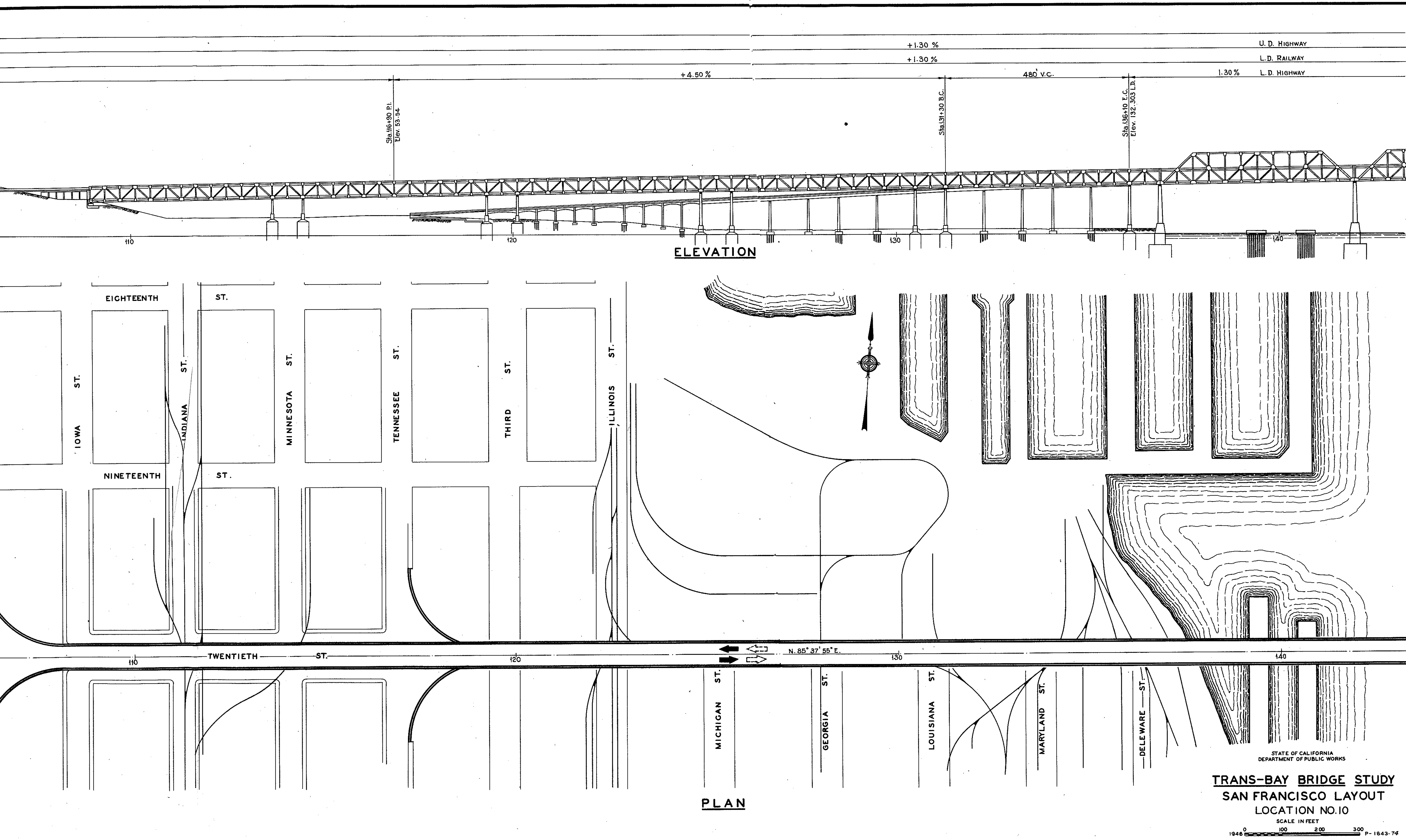

Steel Structure
-2.125 %
-2.125 %
400' V.C.
Sta. 333+10.50 B.V.C.
El. 79.759 U.D.
Sta. 337+10.50 E.V.C.
El. 67.509 U.D.
23' Clearance
300
305
310
315
320
325
330
335
E-24
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
E-37
E-38
E-39
E-40
E-41
E-42
E-43
E-44
289'-6"
132'-6"
14 @ 175'-0"
= 2450'-0"
3 Spans @ 100'-0" = 300'-0"
80'-0"
80'-0"
13 Spans @ 60'-0
ELEVATION
Sta. 303+48.00
℄ Pier
FERRY ST.
STD. OIL CO.
Sta. 313+45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
SEVENTH ST. SUBWAY
SOUTHERN PACIFIC MAIN LINE TRACKS
S 83° 06' 25" E
S.P. Franchise Line
40'
54' 36.77"
000'
.713'
3.405'
Sta. 301+66.671 E.C.
NAVAL MEDICAL SUPPLY BUILDING
Sta. 336+60.89 B.C.
BAY ST.
PLAN



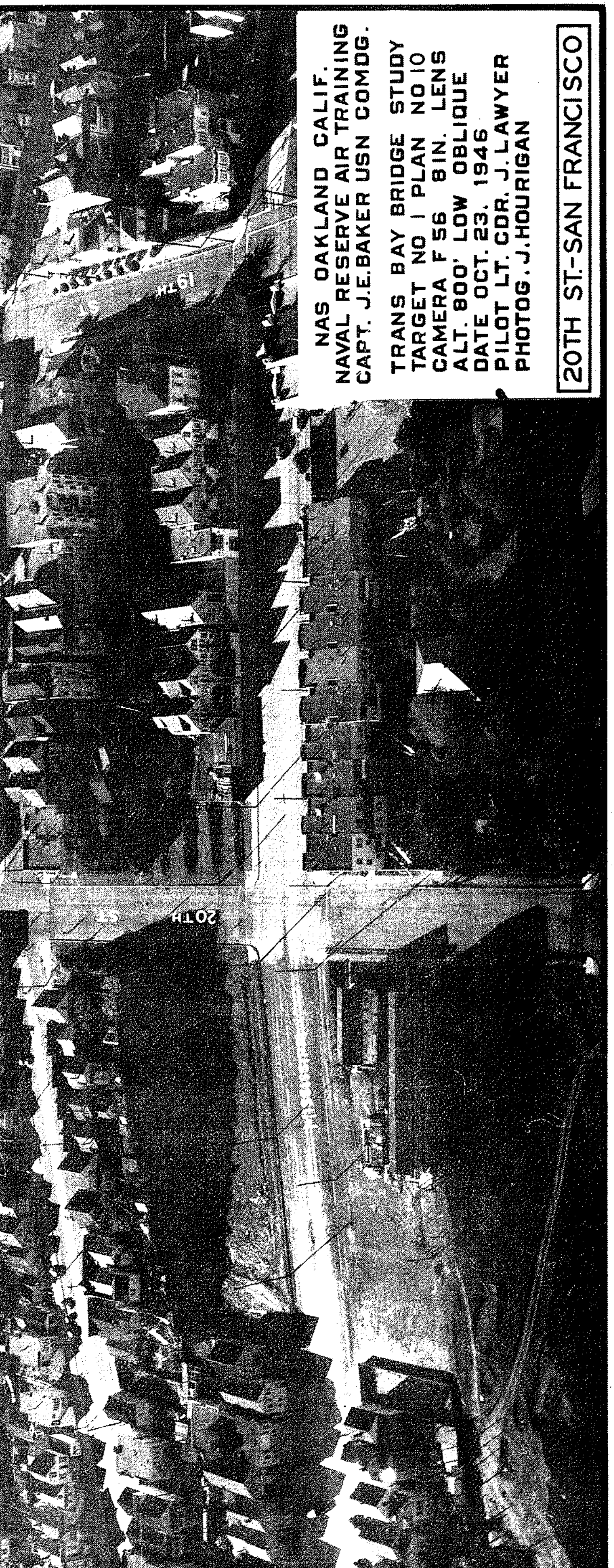
Steel Structure
-2.125 %
-2.125 %
E-20
E-21
E-22
E-23
E-24
E-25
E-26
E-27
E-28
E-29
E-30
E-31
E-32
E-33
E-34
E-35
E-36
290
295
300
305
310
315
320
7 Spans @ 291'-0" = 2037'-0"
289'-6"
132'-6"
14 @ 175'-0" = 2450'-0"
Sta. 303 + 48.00 ℄ Pier
SAN FRANCISCO BAY
Sta. 288 + 33.287 B.C.
Sta. 291 + 66.692 E.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
KRAFT BUILDING
FERRY ST.
STD. OIL CO.
Sta. 313 + 45.37 P.O.T.
MARITIME ST. OVERPASS
Low Tide Line of 1852
S 83° 06' 25" E
S.P. Franchise Line
40'
Sta. 298 + 33.266 B.C.
Δ = 1° 54' 36.77"
R = 10,000'
T = 166.713'
L = 333.405'
Sta. 301 + 66.671 E.C.
NAVAL MEDICAL SUPPLY BUILDING

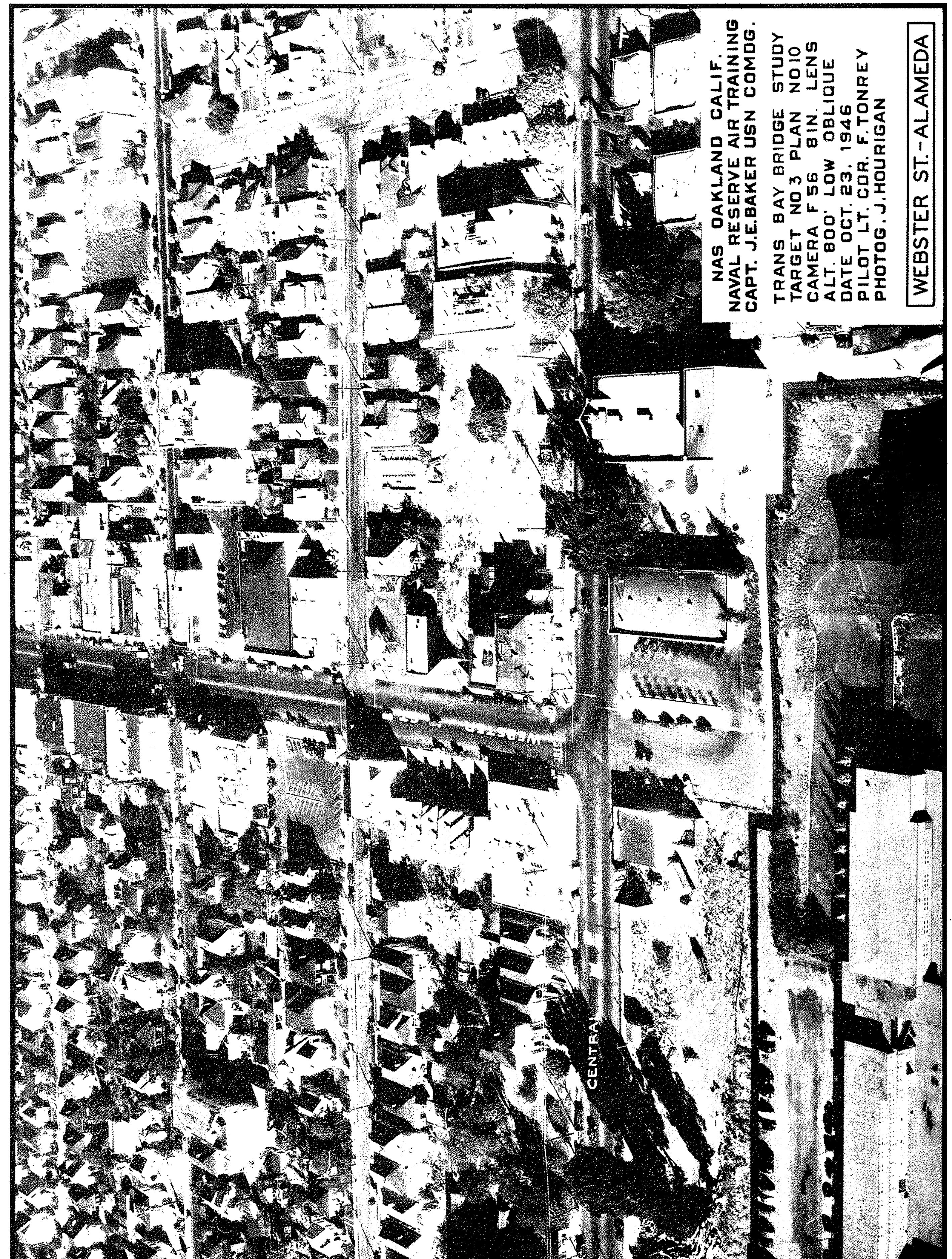

Total Length of Project = 45,300′ or 8.58 miles
-1.30%
19000′ V.C.
-0.44%
1500′ V.C.
-1.30%
1500′ V.C.
512′
510.5′
12 @ 509′ = 6108′
50′
20 @ 291′ = 5820′
205′
11 @ 120′ = 1320′
190
140′
45 @ 120′ = 5400′
5800′ R.R. Viaduct
El. 226.0
El. 60.70
El. 38.57
El. 25.52
El. 15.77
37,390′ Steel Structure
Concrete Retaining Wall 630′
300′
Sta. 294+01
Sta. 352+21
Sta. 424+80
Sta. 482+80
Sta. 489+10
Sta. 492+10
R.R. CONNECTION-LINCOLN AVE. NEAR CHAPIN ST.
ELEVATION
66′
26′ Roadway
4′
26′ Roadway
28′ Roadway
SECTION
ALAMEDA NAVAL AIR STATION
OAKLAND
ESTUARY
ALAMEDA
U. S. PIERHEAD LINE
BAY
TRANS-BAY BRIDGE
TOLL PLAZA
ATLANTIC AVE
BUENA VISTA
EAGLE AVE
PACIFIC
LINCOLN
HAIGHT
TAYLOR AVE
SANTA CLARA
CENTRAL
SAN ANTONIO
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 10
SCALE IN FEET
0
1000
2500
1946
P-1843

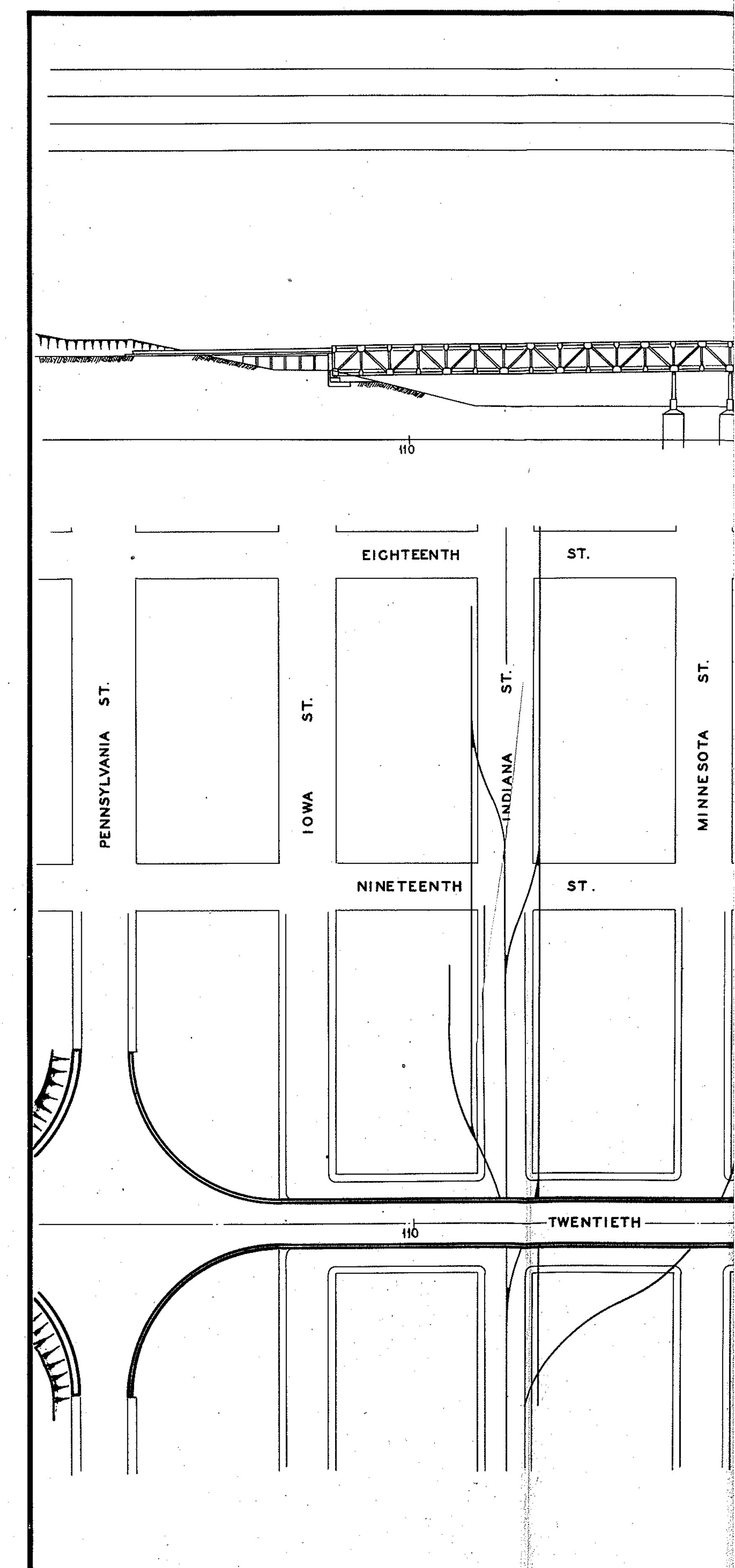

Total Length of Project = 45,300′ or 8.58 miles
+1.30%
1400′ V.C.
-1.30%
3000′ R.R. Viaduct
2300′ R.R. Tunnel
12 @ 509′ = 6108′
12 @ 509′ = 6108′
3000′ Steel Structure
Concrete Structure
37,390′ Steel Structure
Sta. 53+90
Sta. 83+90
Sta. 106+90
Sta. 108+90
Sta. 136+90
Sta. 208+20.50
Sta. 294+01
El. 226.0
1000′ Channel Clearance
ELEVATION
SAN FRANCISCO
CHINA BASIN
CENTRAL BASIN
POTRERO
HILL
FREEWAY
U.S. PIERHEAD LINE
SAN FRANCISCO BAY
TRANS-BAY BRIDGE
1000′ CHANNEL CLEARANCE
W.P. Co. Slip
ISLAIS CREEK CHANNEL
66′
26′ Roadway
4′
26′ Roadway
28′ Roadway
SECTION
PLAN



+1.30 %
U. D. HIGHWAY
+1.30 %
L. D. RAILWAY
+4.50 %
480' V.C.
1.30 %
L. D. HIGHWAY
Sta.116+90 P.I.
Elev. 53.54
Sta.131+30 B.C.
Sta.136+10 E.C.
Elev. 132.303 L.D.
110
120
130
140
ELEVATION
EIGHTEENTH
ST.
IOWA
ST.
INDIANA
ST.
MINNESOTA
ST.
TENNESSEE
ST.
THIRD
ST.
ILLINOIS
ST.
NINETEENTH
ST.
TWENTIETH
ST.
N. 85° 37' 55" E.
110
120
130
140
MICHIGAN
ST.
GEORGIA
ST.
LOUISIANA
ST.
MARYLAND
ST.
DELEWARE
ST.
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION NO.10
SCALE IN FEET
0
100
200
300
1946
P-1843-74

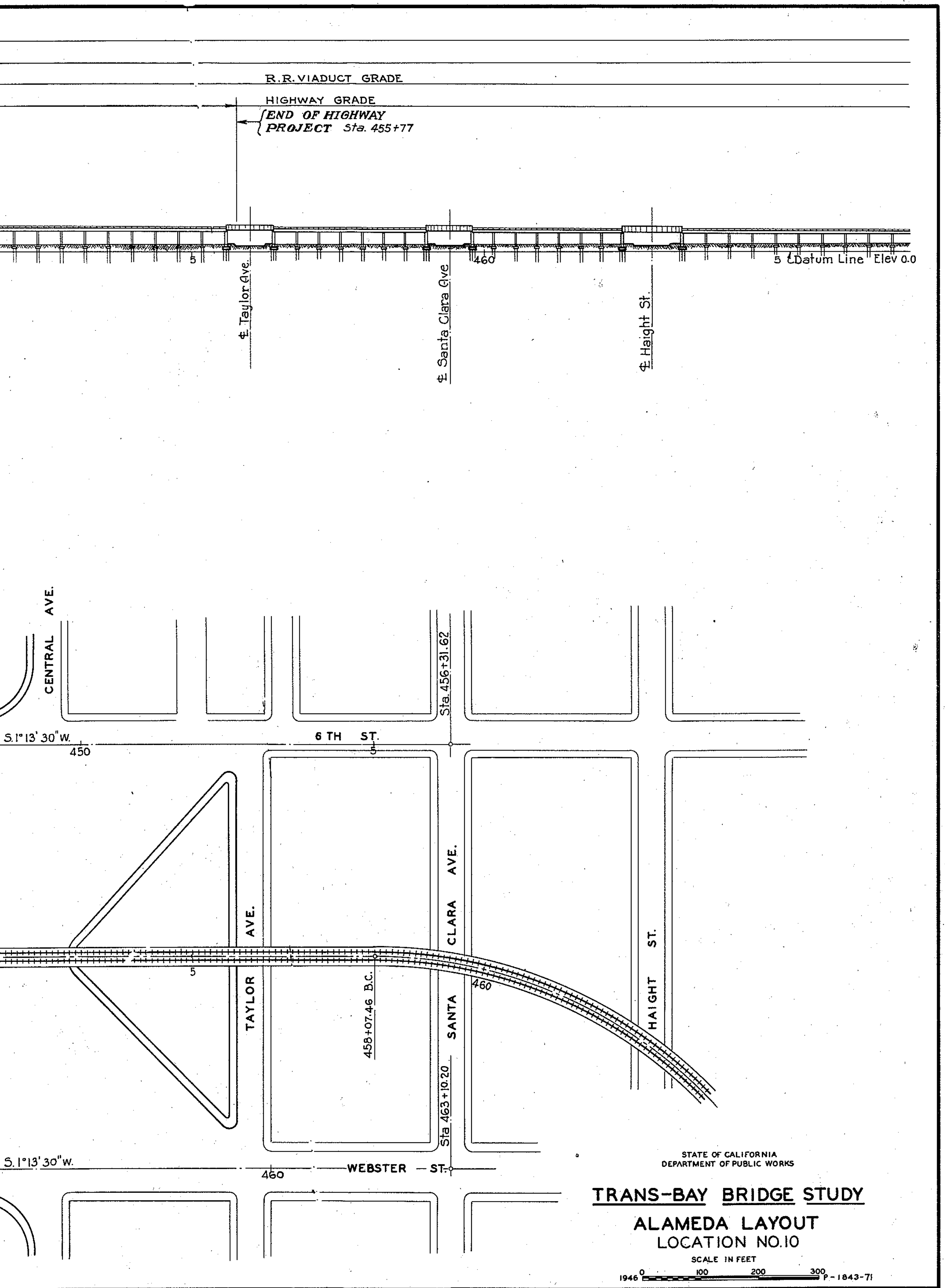

NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 1 PLAN NO 10
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. J. LAWYER
PHOTOG. J. HOURIGAN
20TH ST.-SAN FRANCISCO


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 3 PLAN NO 10
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. F. TONREY
PHOTOG. J. HOURIGAN
WEBSTER ST.-ALAMEDA
CENTRAL

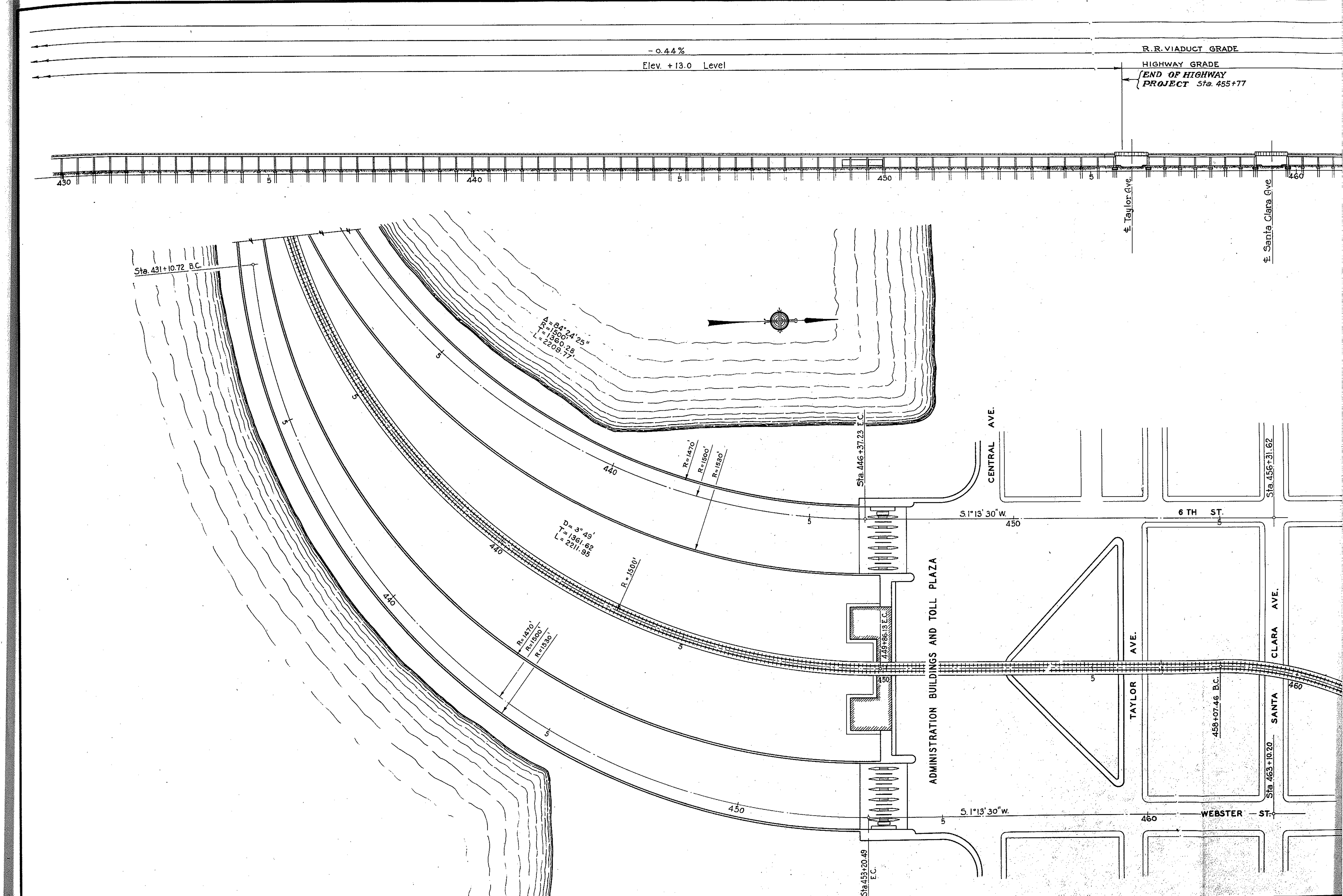

110
EIGHTEENTH
ST.
PENNSYLVANIA ST.
IOWA ST.
INDIANA ST.
MINNESOTA ST.
NINETEENTH
ST.
TWENTIETH
110


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 1 PLAN NO 10
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. J. LAWYER
PHOTOG. J. HOURIGAN
20TH ST.-SAN FRANCISCO
19TH
20TH ST

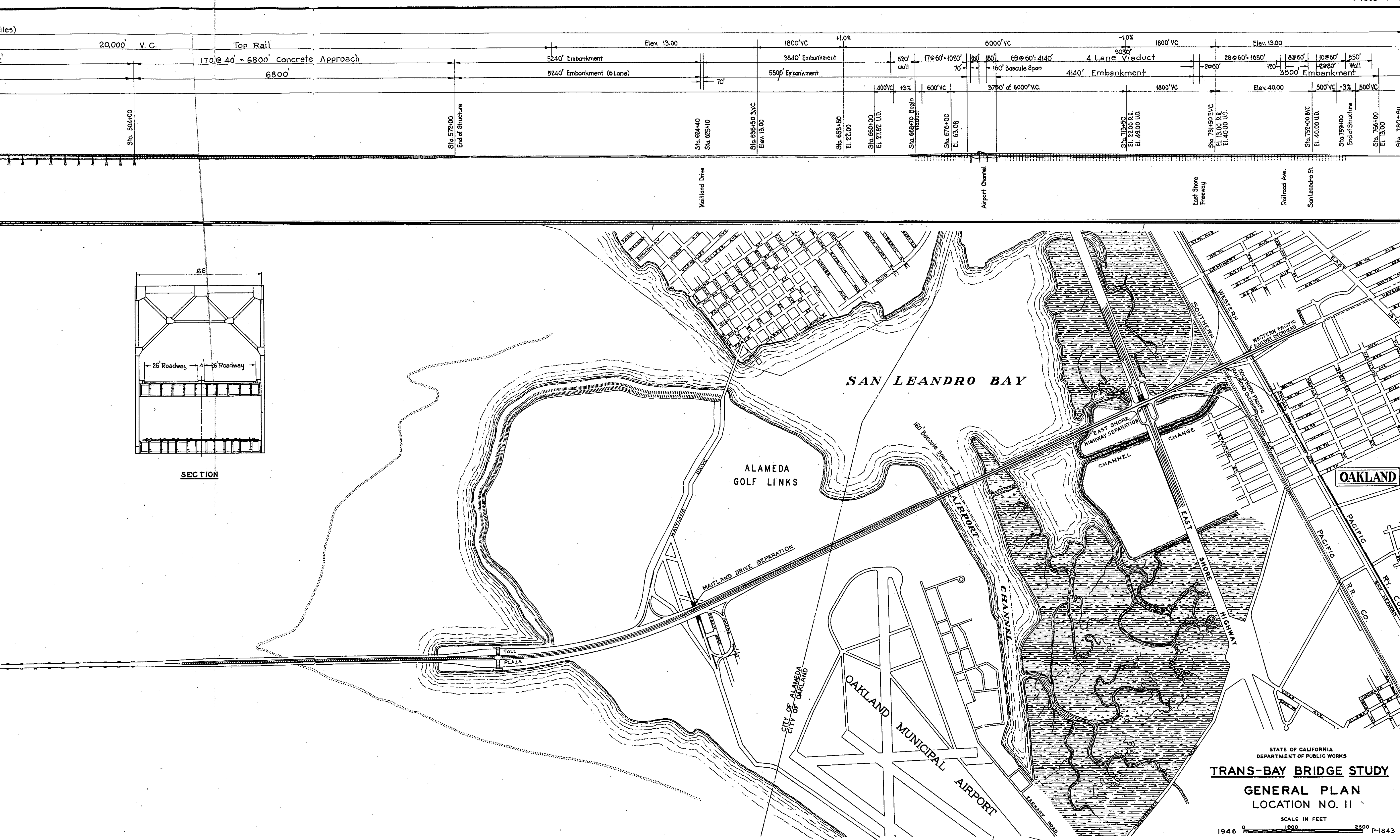

NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 3 PLAN NO 10
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. F. TONREY
PHOTOG. J. HOURIGAN
WEBSTER ST.-ALAMEDA
WEBSTER
CENTRAL

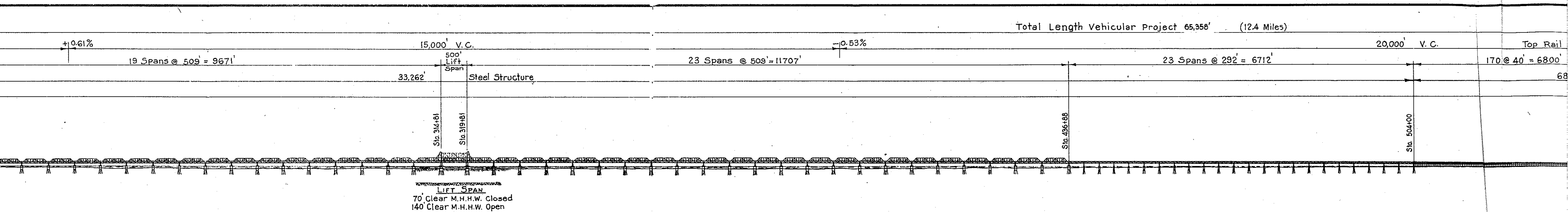

R.R. VIADUCT GRADE
HIGHWAY GRADE
END OF HIGHWAY PROJECT Sta. 455+77
Datum Line Elev 0.0
℄ Taylor Ave.
℄ Santa Clara Ave.
℄ Haight St.
460
CENTRAL AVE.
6TH ST.
S. 1°13' 30" W.
450
Sta. 456+31.62
TAYLOR AVE.
458+07.46 B.C.
SANTA CLARA AVE.
HAIGHT ST.
Sta. 463+10.20
WEBSTER ST.
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
ALAMEDA LAYOUT
LOCATION NO.10
SCALE IN FEET
0 100 200 300
1946 P-1843-71


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 1 PLAN NO 11
CAMERA F56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23, 1946
PILOT LT. CDR. J. LAWYER
PHOTOG. J. HOURIGAN
CANDLESTICK POINT

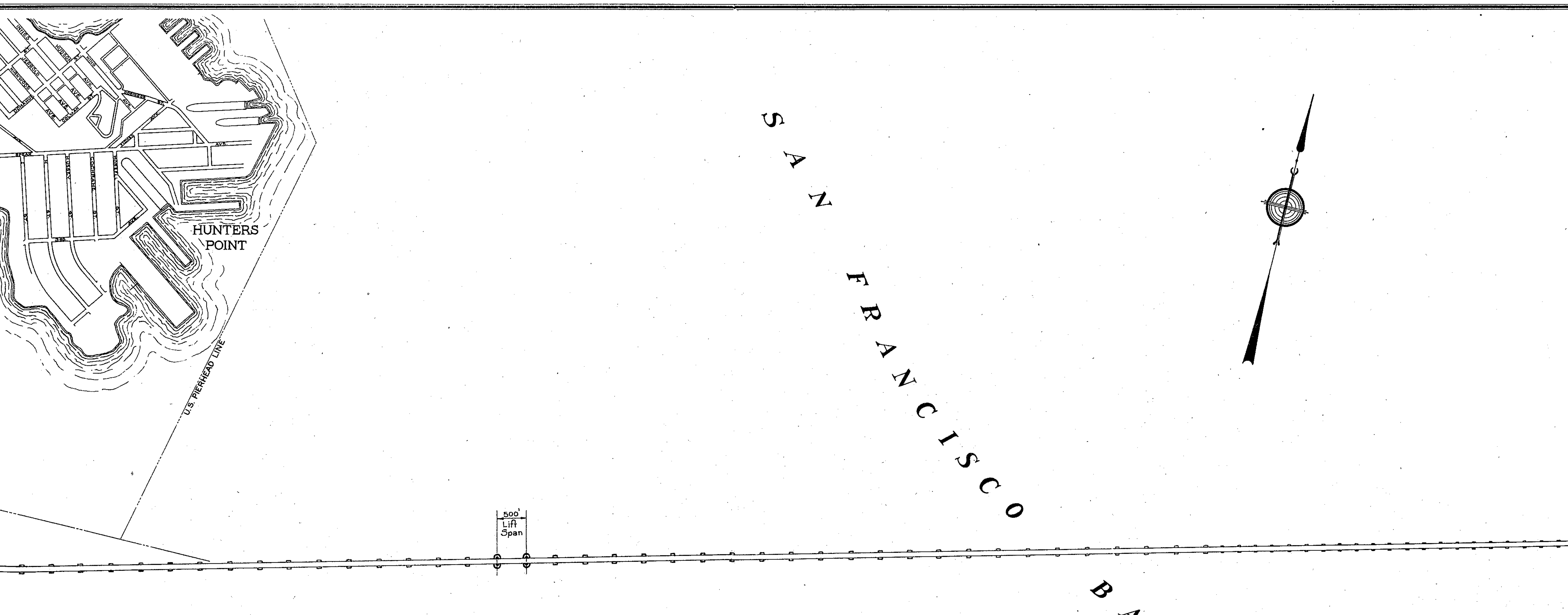


- 0.44%
Elev. + 13.0 Level
R.R. VIADUCT GRADE
HIGHWAY GRADE
END OF HIGHWAY PROJECT Sta. 455+77
430
440
450
460
℄ Taylor Ave.
℄ Santa Clara Ave.
Sta. 431+10.72 B.C.
Δ = 84°24'25"
R = 1500'
T = 1360.28
L = 2209.77'
D = 3° 49'
T = 1361.62
L = 2211.95
R = 1470'
R = 1500'
R = 1530'
R = 1500'
Sta. 446+37.23 E.C.
449+86.13 E.C.
Sta. 453+20.49 E.C.
ADMINISTRATION BUILDINGS AND TOLL PLAZA
CENTRAL AVE.
S. 1° 13' 30" W.
6 TH ST.
TAYLOR AVE.
458+07.46 B.C.
SANTA CLARA AVE.
Sta. 456+31.62
Sta. 463+10.20
WEBSTER ST.

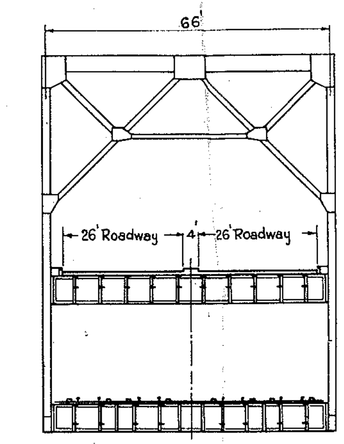

20,000' V.C.
Top Rail
170 @ 40' = 6800' Concrete Approach
6800'
Elev. 13.00
5240' Embankment
5240' Embankment (6 Lane)
70'
1800'VC
+1.0%
3840' Embankment
5500' Embankment
6000'VC
-1.0%
1800'VC
Elev. 13.00
4 Lane Viaduct
4140' Embankment
3500' Embankment
160' Bascule Span
3750' of 6000'V.C.
Elev. 40.00
Sta. 504+00
Sta. 572+00 End of Structure
Maitland Drive
Airport Channel
East Shore Freeway
Railroad Ave.
San Leandro St.
EAST 14TH ST.
66
26' Roadway
4
26' Roadway
SECTION
SAN LEANDRO BAY
ALAMEDA GOLF LINKS
MAITLAND DRIVE SEPARATION
TOLL PLAZA
160' Bascule Span
AIRPORT CHANNEL
EAST SHORE HIGHWAY SEPARATION
CHANGE CHANNEL
EAST SHORE HIGHWAY
WESTERN PACIFIC RAILWAY OVERHEAD
SOUTHERN PACIFIC RAILROAD OVERHEAD
SOUTHERN PACIFIC RY. CO.
WESTERN PACIFIC R.R. CO.
OAKLAND
CITY OF ALAMEDA
CITY OF OAKLAND
OAKLAND MUNICIPAL AIRPORT
EARHART ROAD
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
GENERAL PLAN
LOCATION NO. 11
SCALE IN FEET
1946
P-1843



ELEVATION

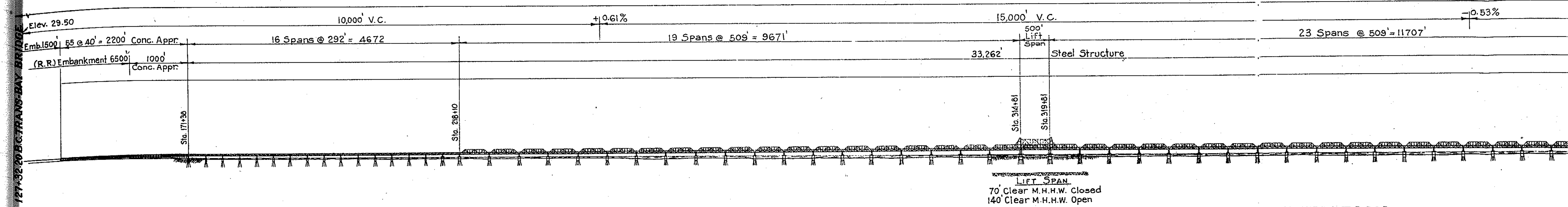


PLAN

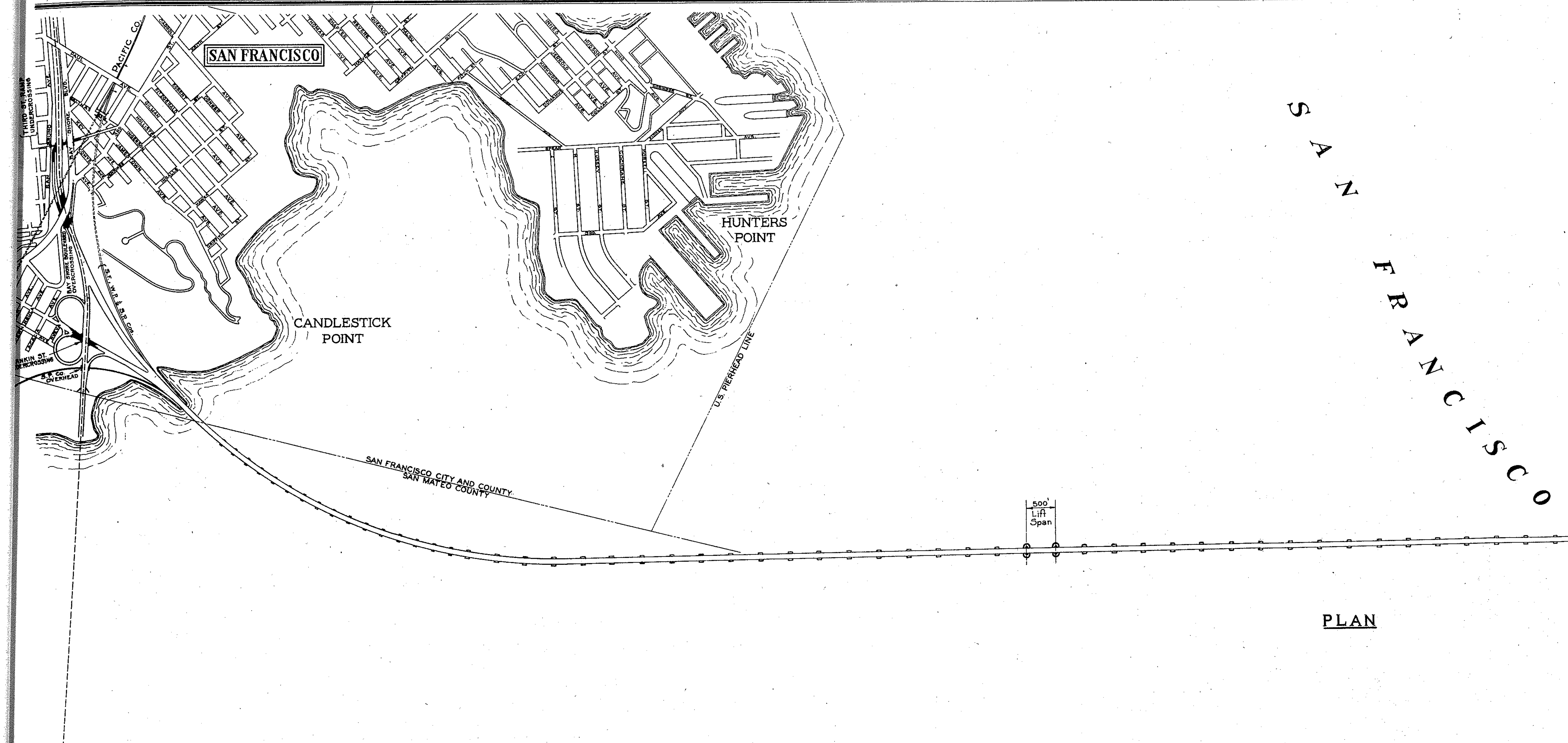


SECTION

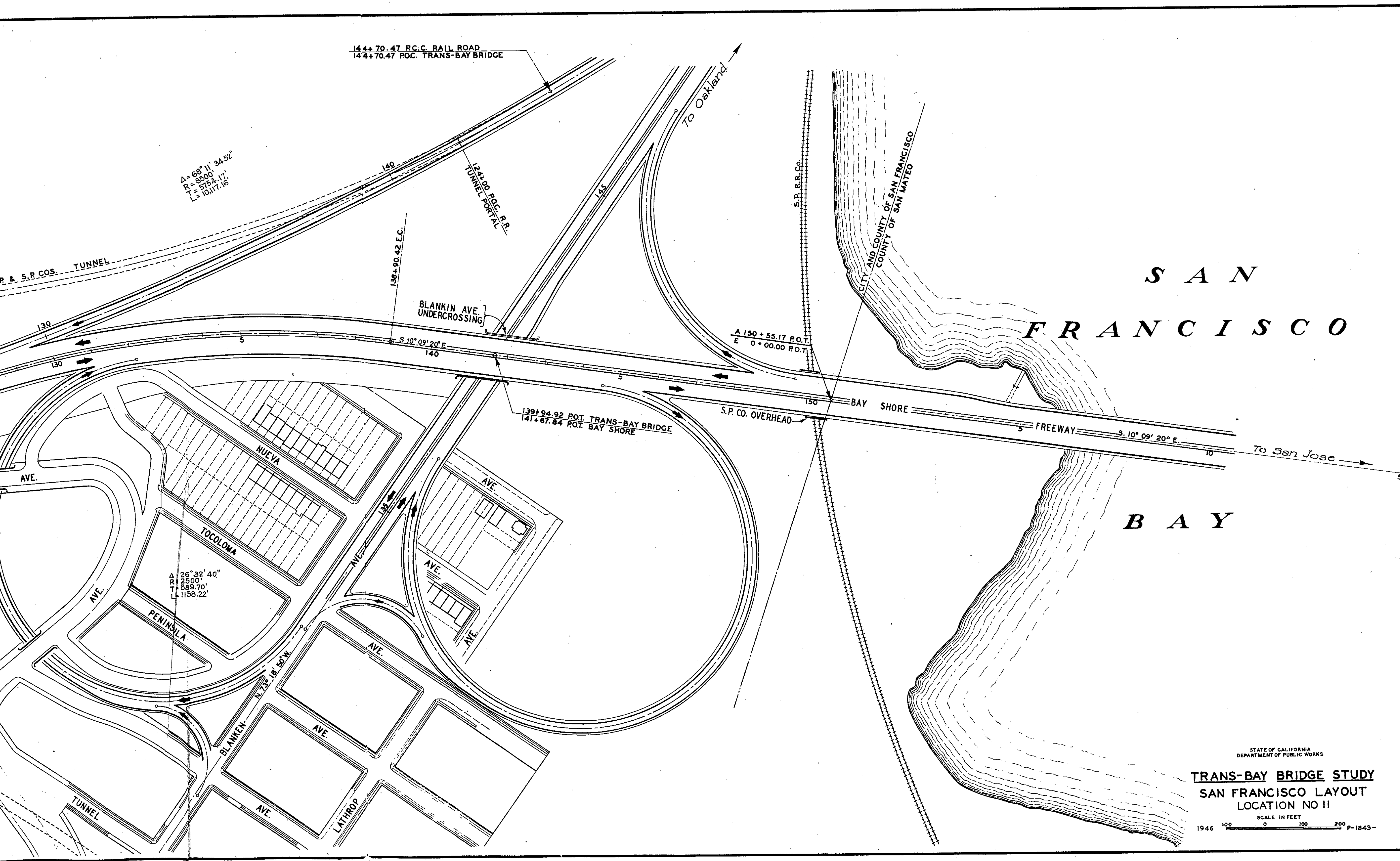
127+32.20 B.C. TRANS-BAY BRIDGE



ELEVATION



PLAN

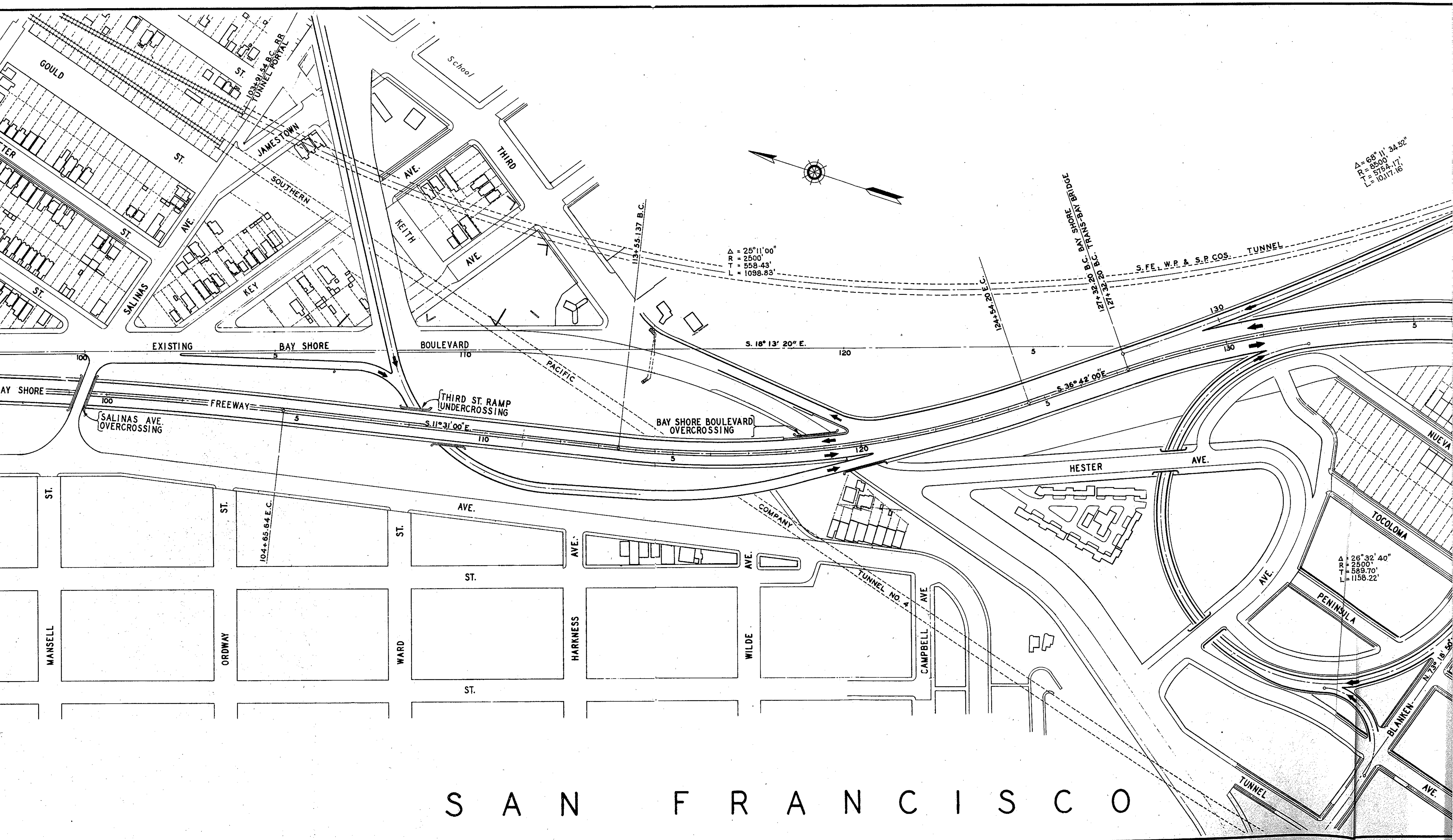


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

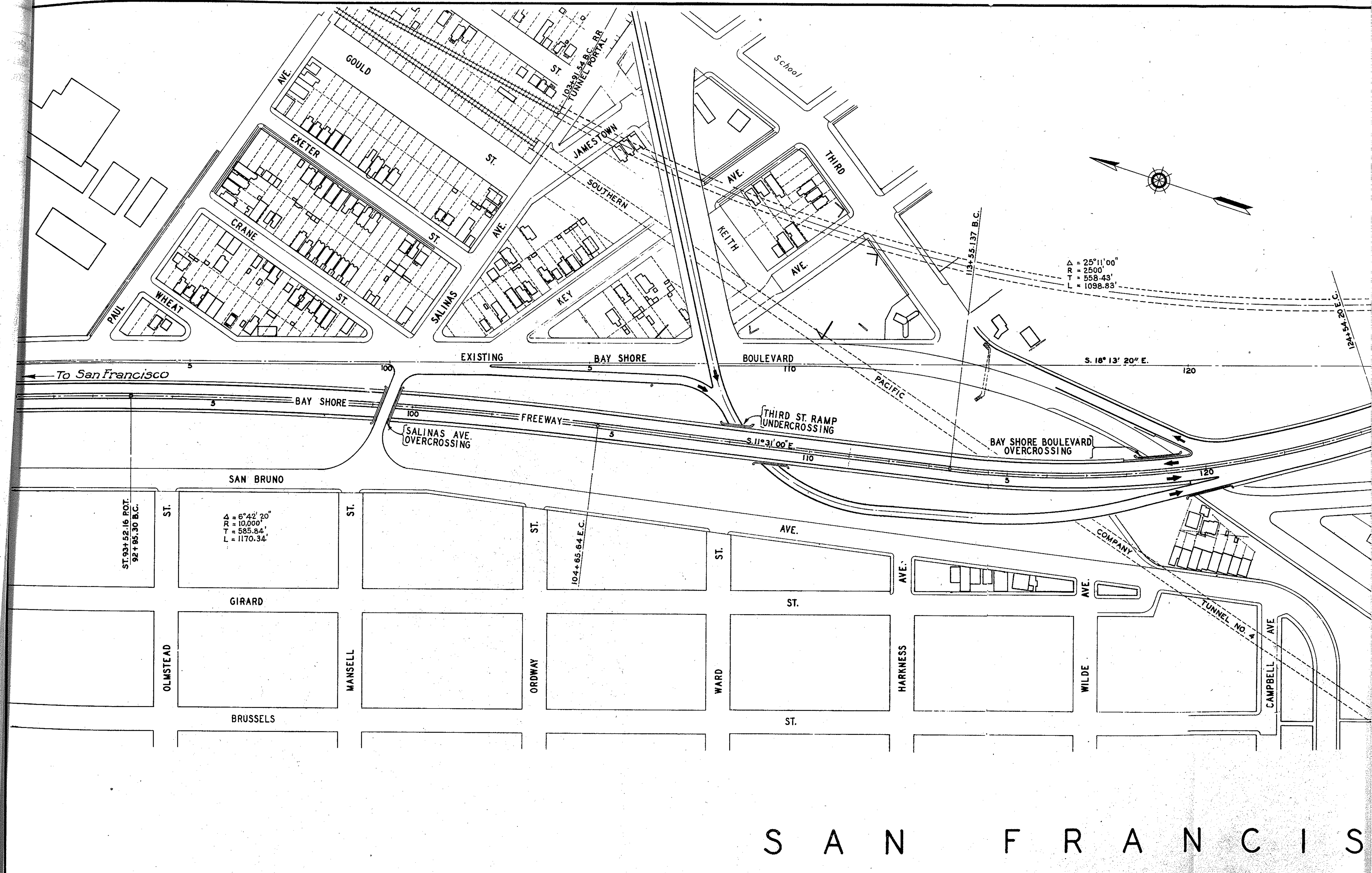
TRANS-BAY BRIDGE STUDY
SAN FRANCISCO LAYOUT
LOCATION NO 11

SCALE IN FEET
100 0 100 300

1946 P-1843-



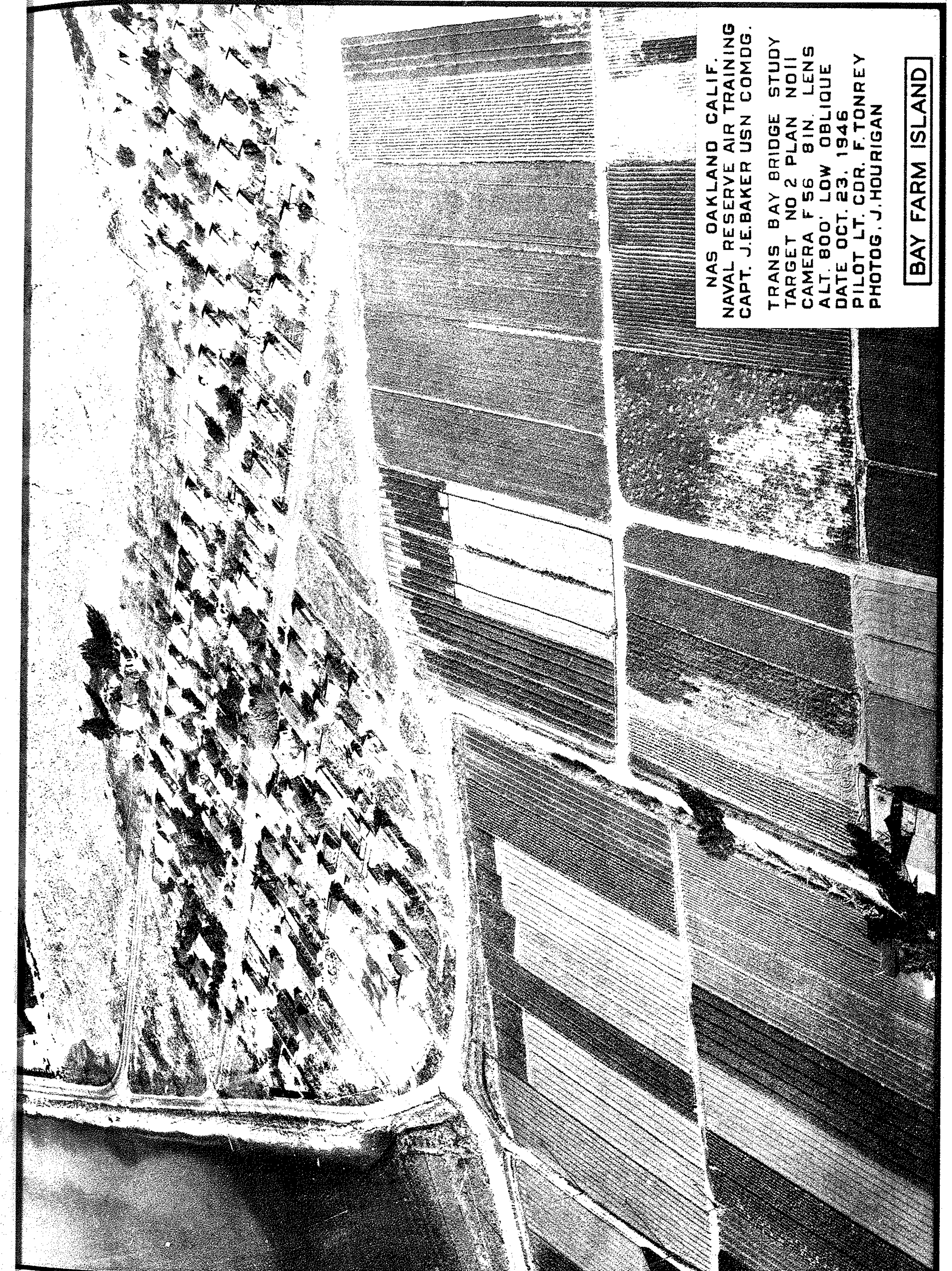
GOULD ST.
SALINAS AVE.
KEY
JAMESTOWN AVE.
SOUTHERN
PACIFIC
COMPANY
TUNNEL NO. 4
School
THIRD
KEITH
AVE.
103+91.54 B.C. RR TUNNEL PORTAL
113+55.137 B.C.
Δ = 25°11'00"
R = 2500'
T = 558.43'
L = 1098.83'
S. FE., W.P. & S.P. COS. TUNNEL
124+54.20 E.C.
127+32.20 B.C. BAY SHORE
127+32.20 B.C. TRANS-BAY BRIDGE
Δ = 68°11' 34.52"
R = 8500'
T = 5754.17'
L = 10,117.16'
EXISTING BAY SHORE BOULEVARD
S. 18° 13' 20" E.
BAY SHORE FREEWAY
SALINAS AVE. OVERCROSSING
THIRD ST. RAMP UNDERCROSSING
S. 11° 31' 00" E.
BAY SHORE BOULEVARD OVERCROSSING
S. 36° 42' 00" E.
104+65.64 E.C.
HESTER AVE.
NUEVA
TOCOLOMA
PENINSULA
BLANKEN AVE.
Δ = 26° 32' 40"
R = 2500'
T = 589.70'
L = 1158.22'
N. 23° 18' 50"
TUNNEL
MANSELL ST.
ORDWAY ST.
WARD ST.
HARKNESS AVE.
WILDE AVE.
CAMPBELL AVE.
ST.
SAN FRANCISCO



GOULD ST.
EXETER ST.
CRANE ST.
WHEAT
PAUL AVE.
SALINAS AVE.
KEY AVE.
JAMESTOWN AVE.
KEITH AVE.
THIRD
School
103+91.54 B.C. RR
TUNNEL PORTAL
SOUTHERN PACIFIC COMPANY
TUNNEL NO. 4
13+55.137 B.C.
Δ = 25°11'00"
R = 2500'
T = 558.43'
L = 1098.83'
124+54.20 E.C.
EXISTING BAY SHORE BOULEVARD
S. 18° 13' 20" E.
To San Francisco
BAY SHORE FREEWAY
SALINAS AVE. OVERCROSSING
THIRD ST. RAMP UNDERCROSSING
S. 11° 31' 00" E.
BAY SHORE BOULEVARD OVERCROSSING
SAN BRUNO AVE.
ST. 93+52.16 POT.
92+95.30 B.C.
Δ = 6°42'20"
R = 10,000'
T = 585.84'
L = 1170.34'
104+65.64 E.C.
GIRARD ST.
BRUSSELS ST.
OLMSTEAD ST.
MANSELL ST.
ORDWAY ST.
WARD ST.
HARKNESS AVE.
WILDE AVE.
CAMPBELL AVE.
SAN FRANCIS


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 2 PLAN NO11
CAMERA F 56 8 IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23, 1946
PILOT LT. CDR. F.TONREY
PHOTOG. J.HOURIGAN
BAY FARM ISLAND


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 3 PLAN NO 11
CAMERA F 56 8 IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23, 1946
PILOT LT. CDR. F. TONREY
PHOTOG. J. HOURIGAN
BAY FARM ISLAND


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 2 PLAN NO11
CAMERA F 56 8IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
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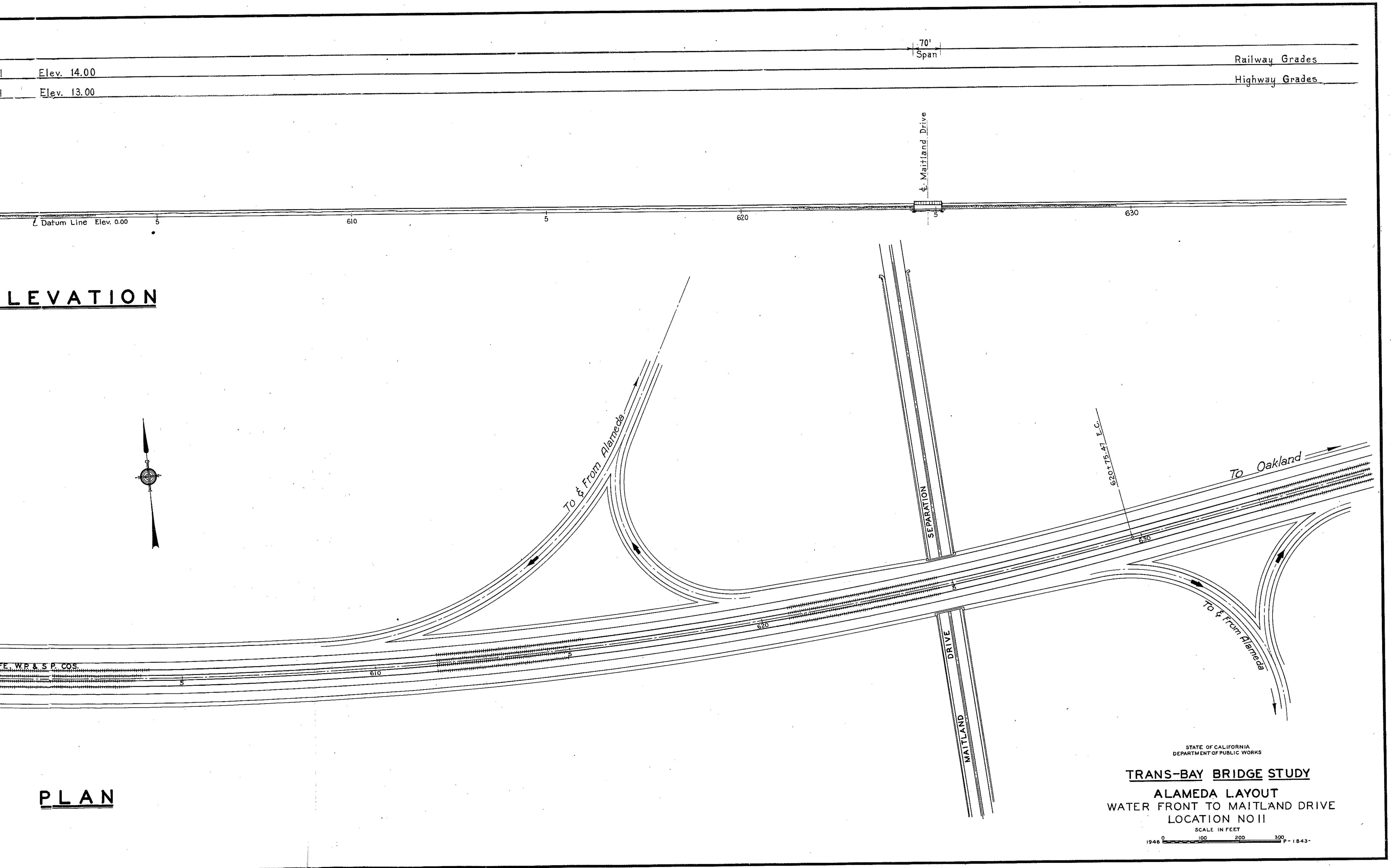
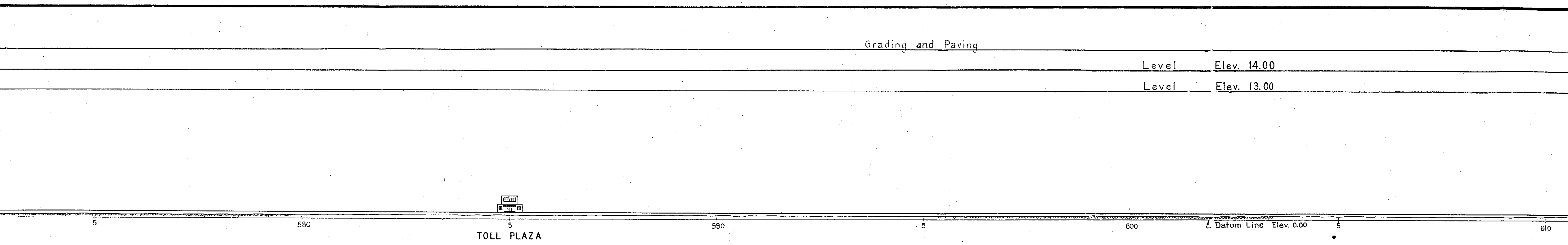
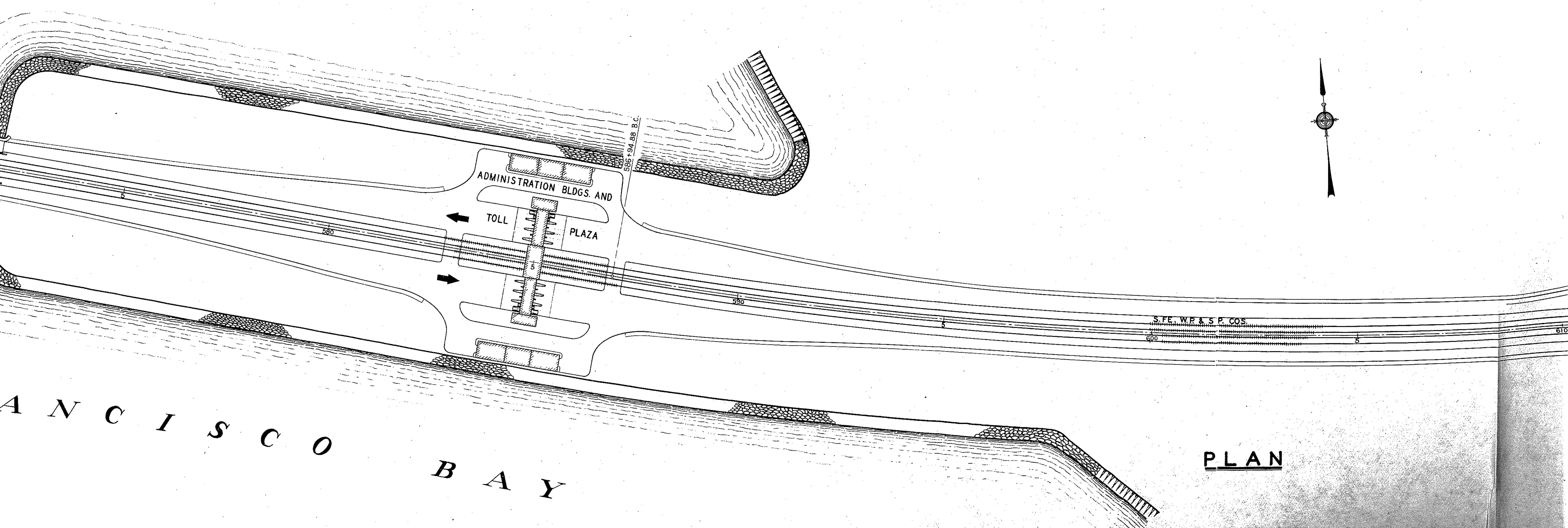
NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 3 PLAN NO 11
CAMERA F 56 8 IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23. 1946
PILOT LT. CDR. F.TONREY
PHOTOG. J.HOURIGAN
BAY FARM ISLAND

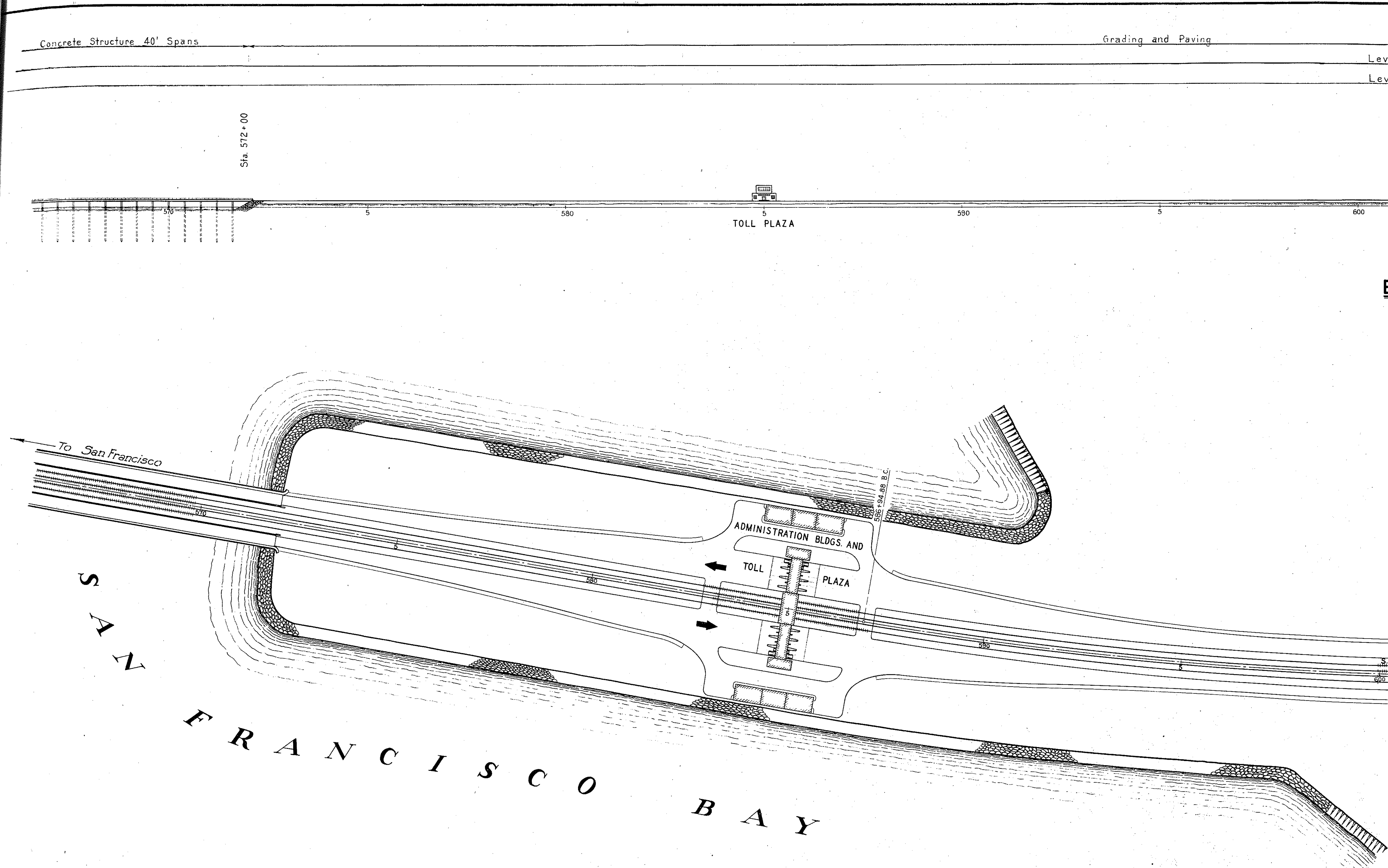

70'
Span
Railway Grades
Highway Grades
Elev. 14.00
Elev. 13.00
℄ Maitland Drive
℄ Datum Line Elev. 0.00
5
610
5
620
5
630
LEVATION
To & From Alameda
To Oakland
620+75.47 E.C.
SEPARATION
DRIVE
MAITLAND
To & From Alameda
E. W.P. & S.P. COS.
610
620
630
PLAN
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
ALAMEDA LAYOUT
WATER FRONT TO MAITLAND DRIVE
LOCATION NO II
SCALE IN FEET
0 100 200 300
1946
P-1843-



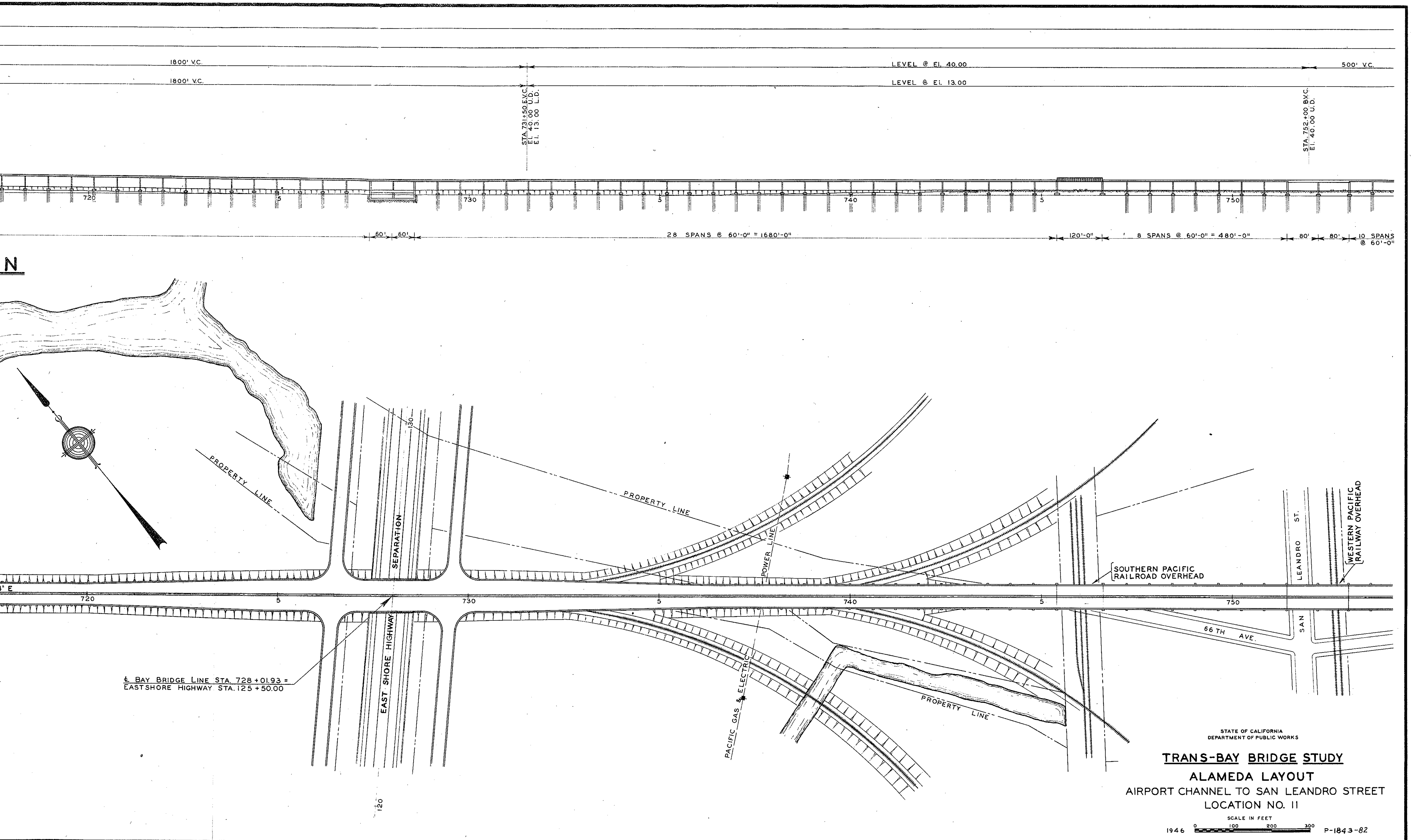
ELEVATION

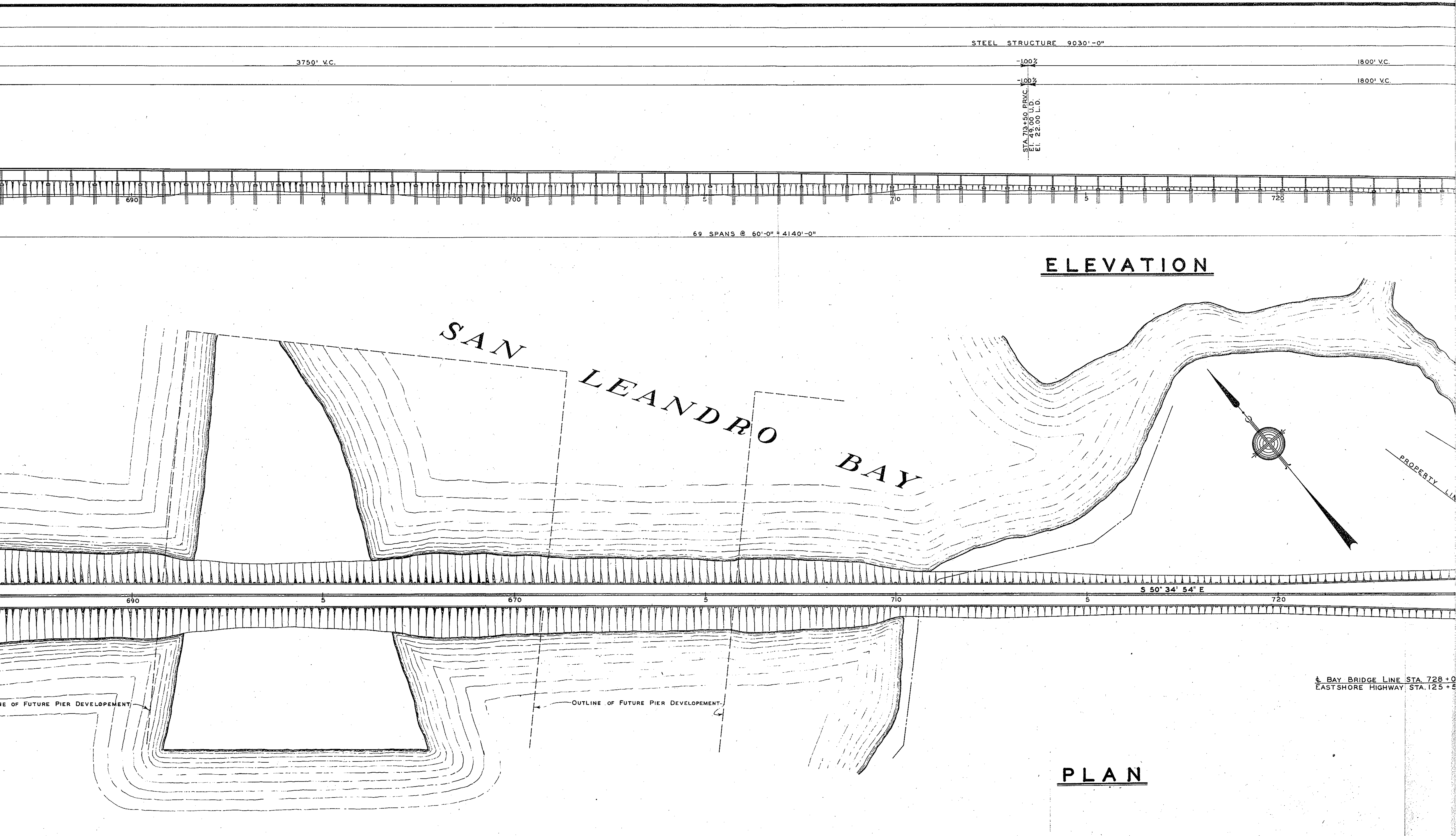


PLAN

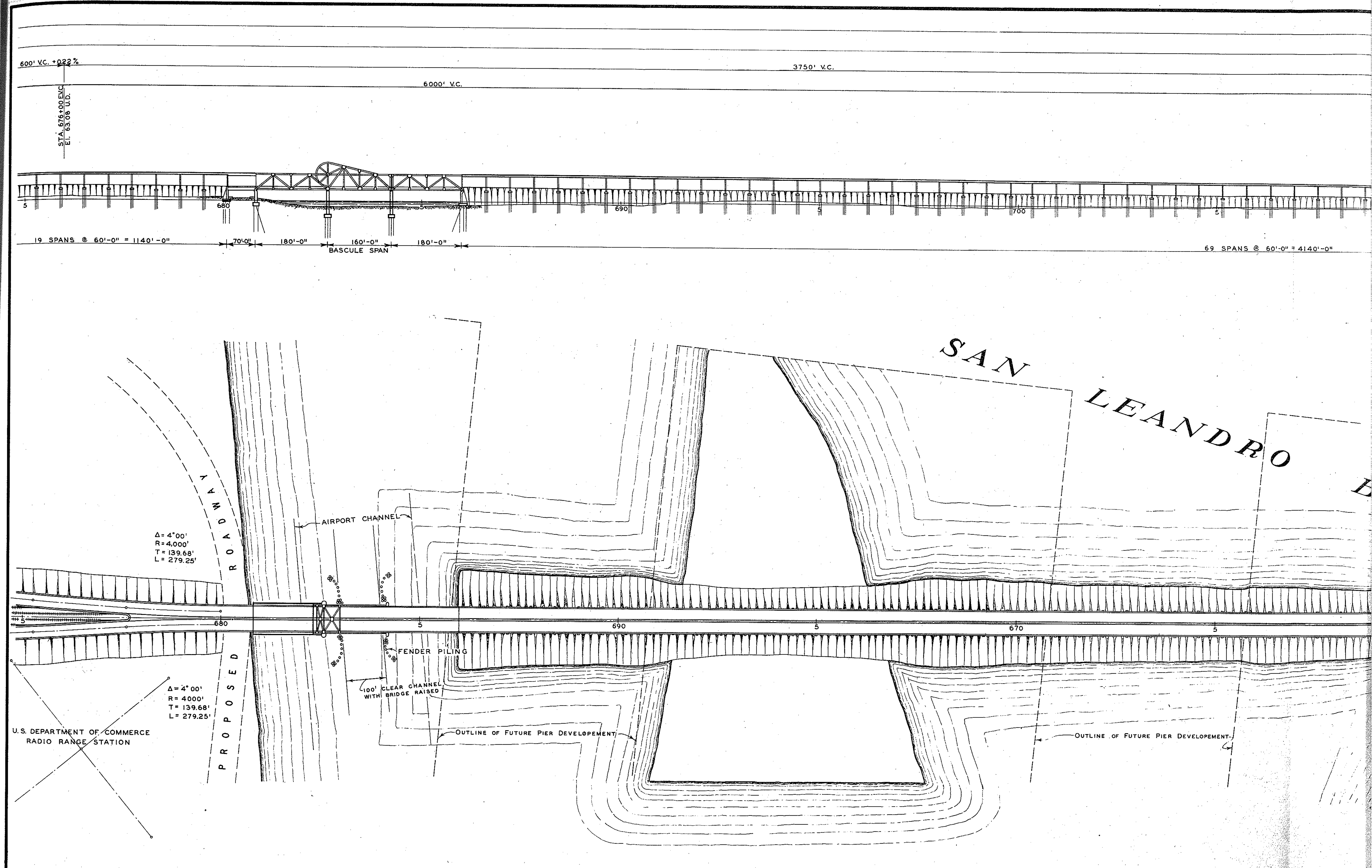


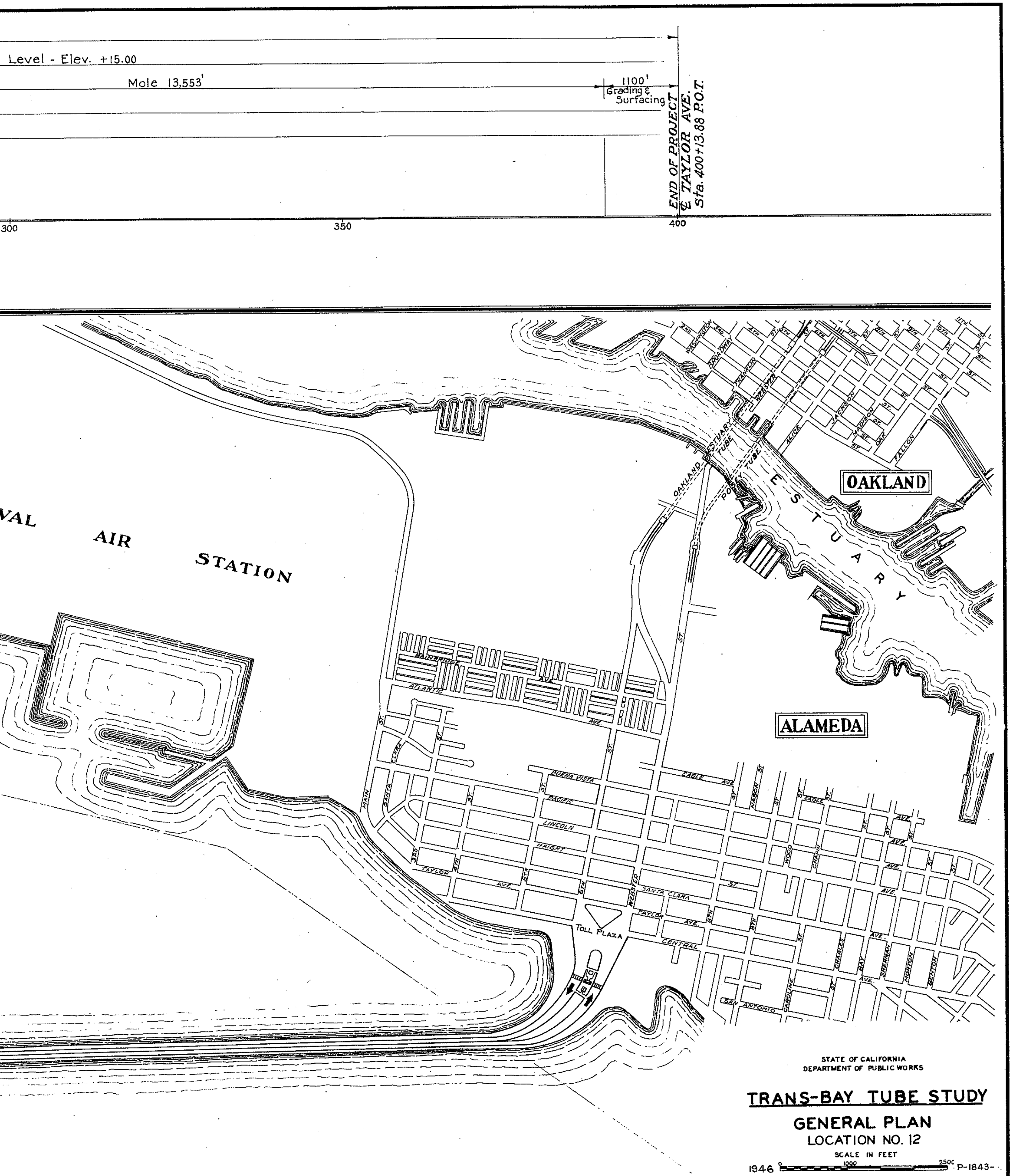
Concrete Structure 40' Spans
Grading and Paving
Level
Level
Sta. 572+00
570
5
580
5
590
5
600
TOLL PLAZA
To San Francisco
570
5
580
596+94.88 B.C.
ADMINISTRATION BLDGS. AND
TOLL
PLAZA
590
5
600
SAN FRANCISCO BAY


1800' V.C.
1800' V.C.
LEVEL @ El. 40.00
LEVEL @ El. 13.00
500' V.C.
STA. 731+50 E.V.C.
El. 40.00 U.D.
El. 13.00 L.D.
STA. 752+00 B.V.C.
El. 40.00 U.D.
720
730
740
750
60'
60'
28 SPANS @ 60'-0" = 1680'-0"
120'-0"
8 SPANS @ 60'-0" = 480'-0"
80'
80'
10 SPANS @ 60'-0"
N
PROPERTY LINE
PROPERTY LINE
PROPERTY LINE
POWER LINE
SEPARATION
EAST SHORE HIGHWAY
130
120
SOUTHERN PACIFIC RAILROAD OVERHEAD
WESTERN PACIFIC RAILWAY OVERHEAD
SAN LEANDRO ST.
66 TH AVE.
PACIFIC GAS & ELECTRIC
℄ BAY BRIDGE LINE STA. 728+01.93 =
EASTSHORE HIGHWAY STA. 125+50.00
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY BRIDGE STUDY
ALAMEDA LAYOUT
AIRPORT CHANNEL TO SAN LEANDRO STREET
LOCATION NO. 11
SCALE IN FEET
0 100 200 300
1946
P-1843-82

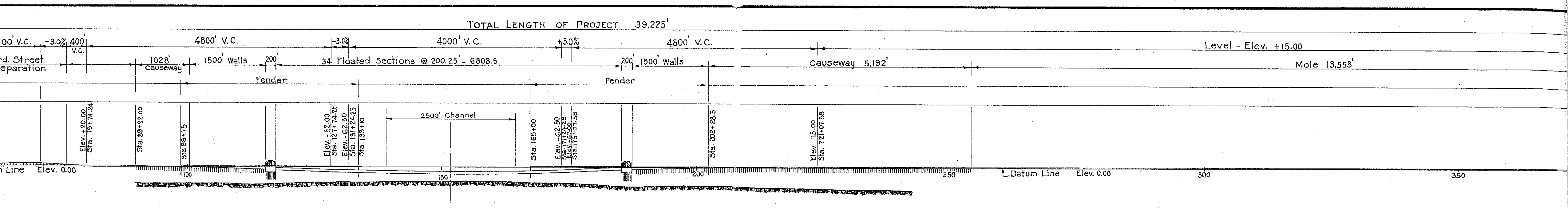


STEEL STRUCTURE 9030'-0"
3750' V.C.
-1.00%
1800' V.C.
STA. 713+50 PRVC.
El. 49.00 U.D.
El. 22.00 L.D.
69 SPANS @ 60'-0" = 4140'-0"
ELEVATION
SAN LEANDRO BAY
OUTLINE OF FUTURE PIER DEVELOPEMENT
S 50° 34' 54" E
PLAN

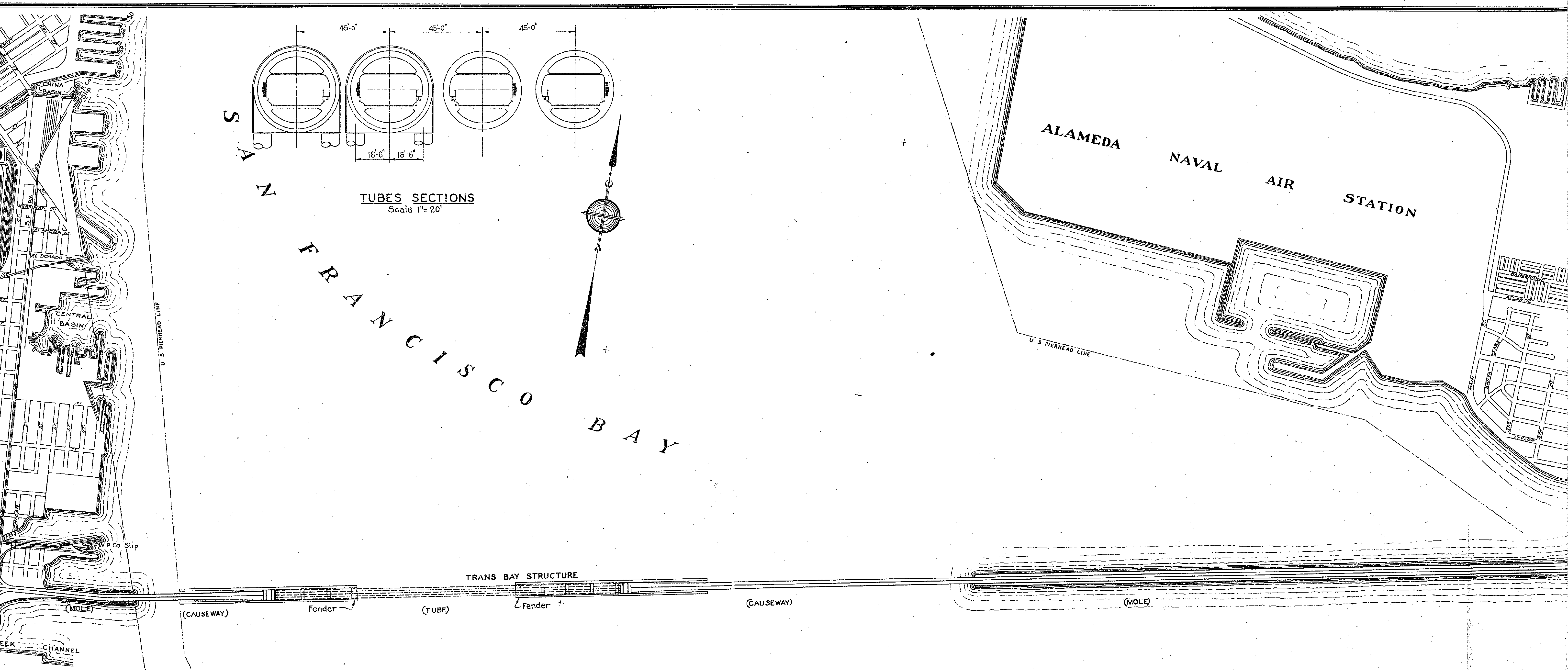

600' V.C. +0.22%
3750' V.C.
6000' V.C.
STA. 676+00 E.V.C.
El. 63.08 U.D.
680
690
700
19 SPANS @ 60'-0" = 1140'-0"
70'-0"
180'-0"
160'-0"
BASCULE SPAN
180'-0"
69 SPANS @ 60'-0" = 4140'-0"
SAN LEANDRO
PROPOSED ROADWAY
AIRPORT CHANNEL
Δ= 4°00'
R= 4,000'
T= 139.68'
L= 279.25'
Δ= 4°00'
R= 4000'
T= 139.68'
L= 279.25'
FENDER PILING
100' CLEAR CHANNEL WITH BRIDGE RAISED
OUTLINE OF FUTURE PIER DEVELOPEMENT
OUTLINE OF FUTURE PIER DEVELOPEMENT
U.S. DEPARTMENT OF COMMERCE
RADIO RANGE STATION

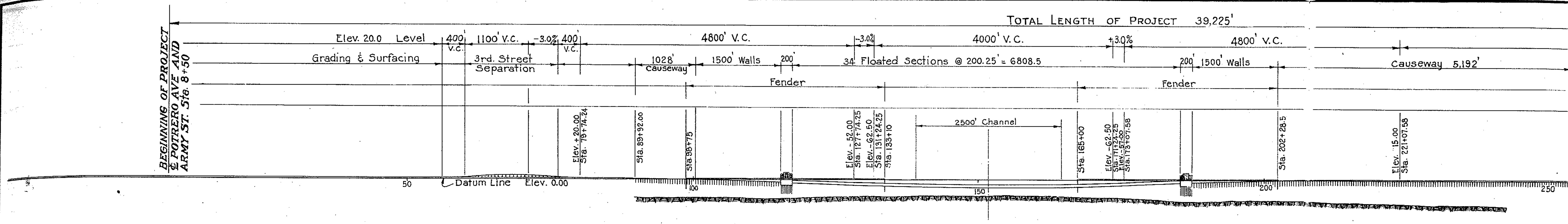

Level - Elev. +15.00
Mole 13,553'
1100'
Grading & Surfacing
END OF PROJECT
℄ TAYLOR AVE.
Sta. 400+13.88 P.O.T.
300
350
400
OAKLAND
ALAMEDA
AVAL AIR STATION
ESTUARY
TOLL PLAZA
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
TRANS-BAY TUBE STUDY
GENERAL PLAN
LOCATION NO. 12
SCALE IN FEET
1946
P-1843-


NAS OAKLAND CALIF.
NAVAL RESERVE AIR TRAINING
CAPT. J.E.BAKER USN COMDG.
TRANS BAY BRIDGE STUDY
TARGET NO 2 PLAN NO 10
CAMERA F 56 8 IN. LENS
ALT. 800' LOW OBLIQUE
DATE OCT. 23, 1946
PILOT LT. CDR. J. LAWYER
PHOTOG. J. HOURIGAN
ARMY ST.-SAN FRANCISCO

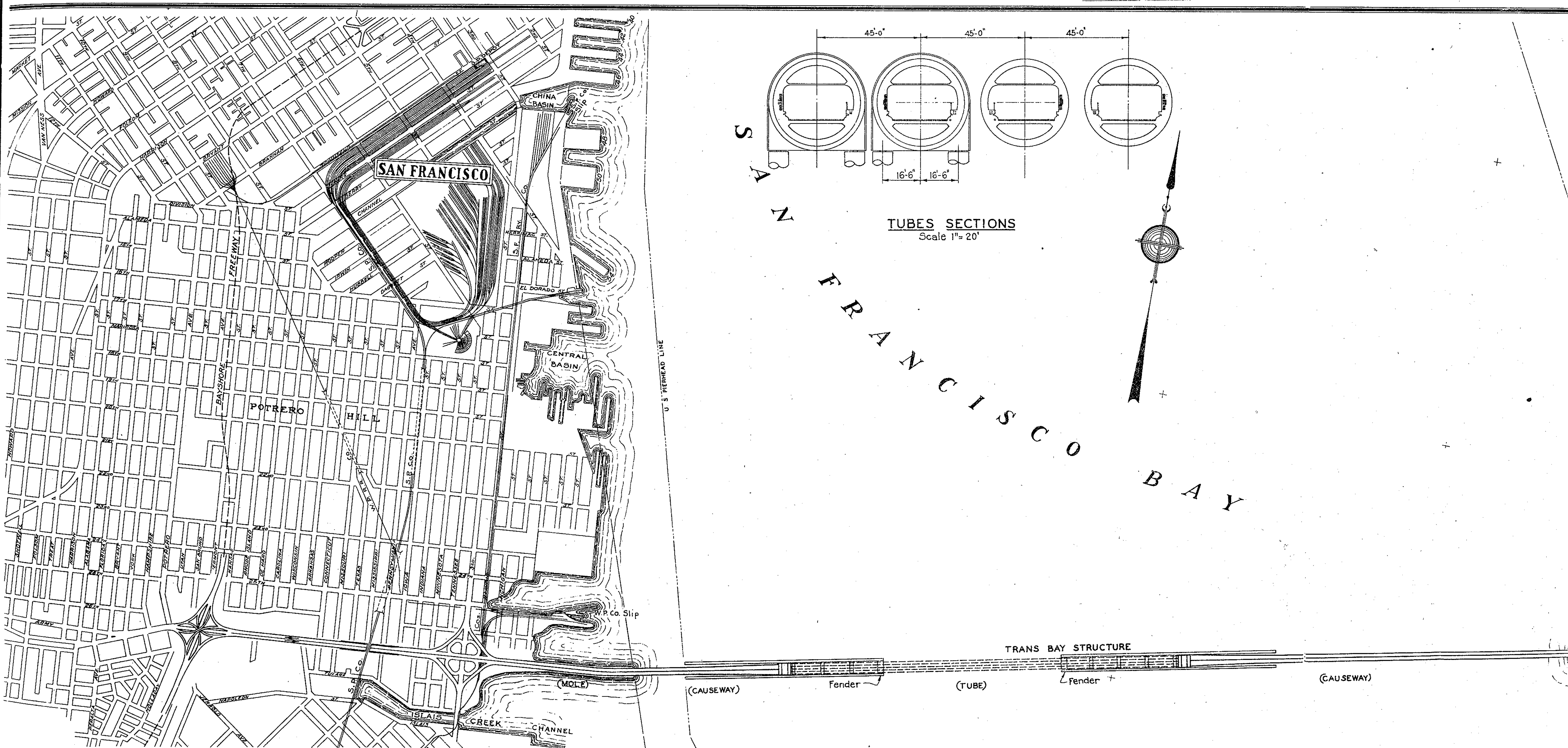

TOTAL LENGTH OF PROJECT 39,225'
00' V.C.
-3.0% 400' V.C.
4800' V.C.
-3.0%
4000' V.C.
+3.0%
4800' V.C.
Level - Elev. +15.00
rd. Street
eparation
1028' Causeway
1500' Walls
200'
34 Floated Sections @ 200.25' = 6808.5
200'
1500' Walls
Causeway 5,192'
Mole 13,553'
Fender
Fender
2500' Channel
Elev. +20.00
Sta. 78+74.24
Sta. 89+92.00
Sta. 98+75
Elev. -52.00
Sta. 127+74.25
Elev. -62.50
Sta. 131+24.25
Sta. 133+10
Sta. 165+00
Elev. -62.50
Sta. 171+24.25
Elev. -52.00
Sta. 173+07.58
Sta. 202+28.5
Elev. 15.00
Sta. 221+07.58
n Line Elev. 0.00
100
150
200
250
Datum Line Elev. 0.00
300
350

ELEVATION

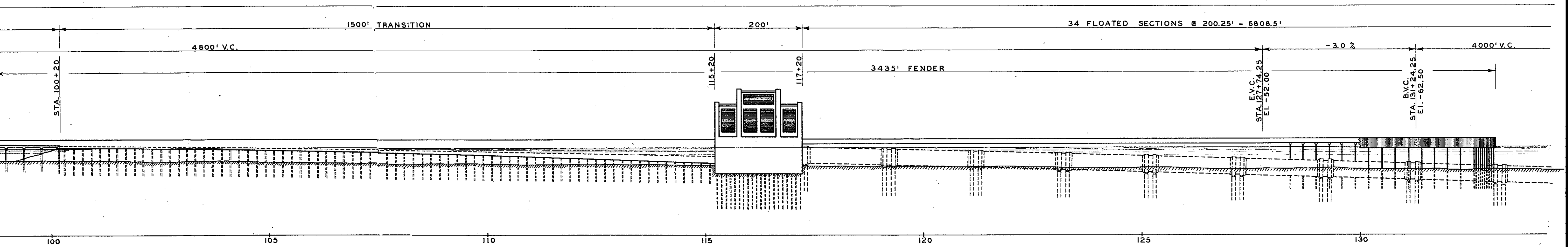

45'-0"
45'-0"
45'-0"
16'-6"
16'-6"
TUBES SECTIONS
Scale 1" = 20'
SAN FRANCISCO BAY
ALAMEDA NAVAL AIR STATION
CHINA BASIN
CENTRAL BASIN
U.S. PIERHEAD LINE
U.S. PIERHEAD LINE
W.P. Co. Slip
(MOLE)
(CAUSEWAY)
Fender
(TUBE)
Fender
TRANS BAY STRUCTURE
(CAUSEWAY)
(MOLE)
EEK
CHANNEL

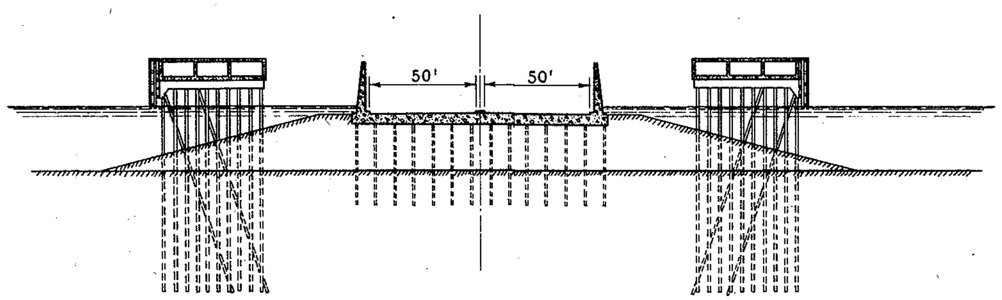


ELEVATION



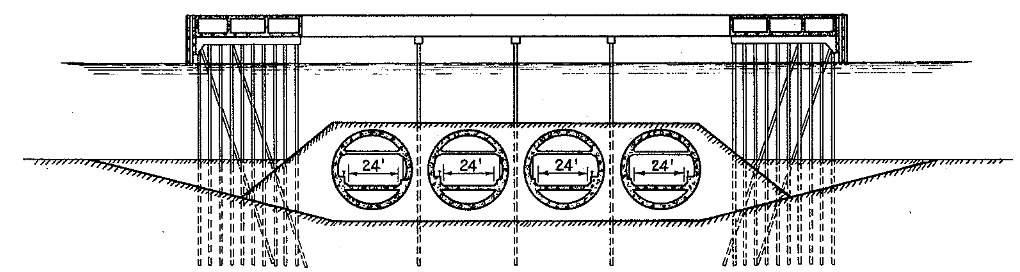
TUBES SECTIONS
Scale 1" = 20'





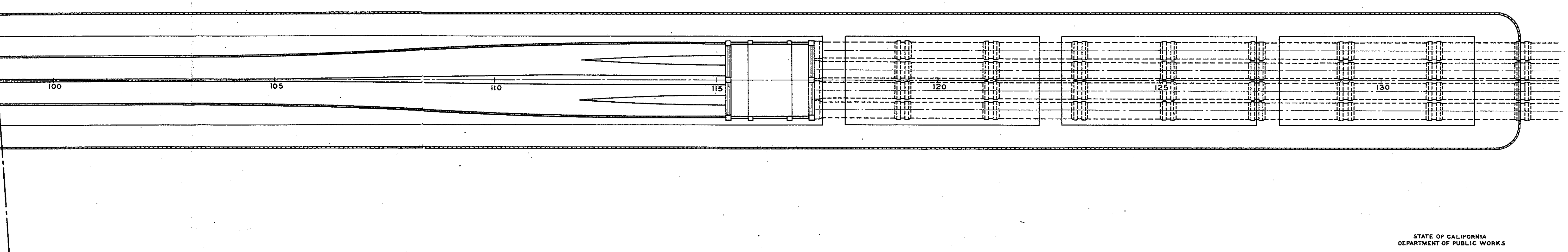
TRANSITION SECTION

Scale : 1" = 40'



TUBE SECTION

Scale : 1" = 40'



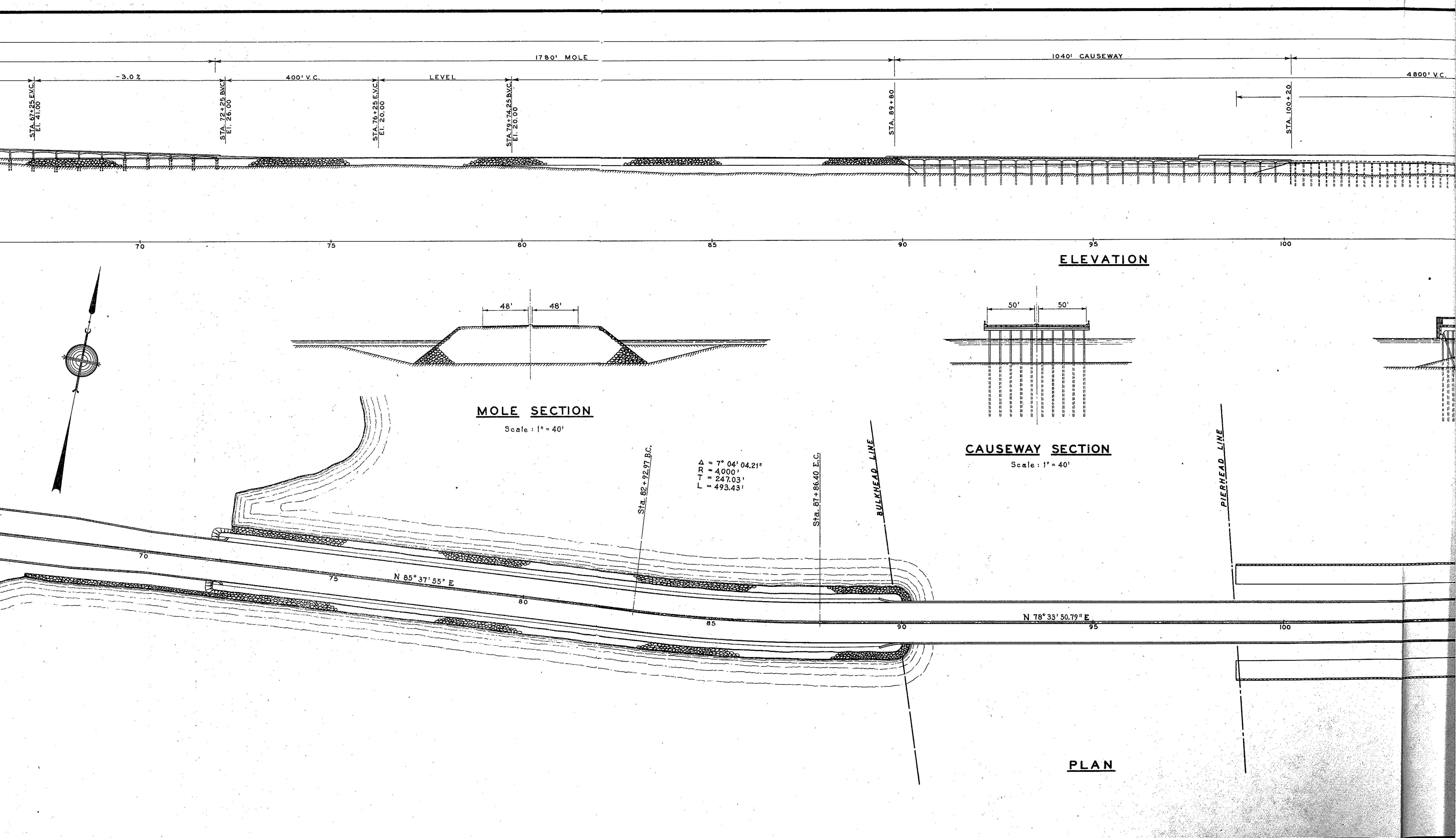
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

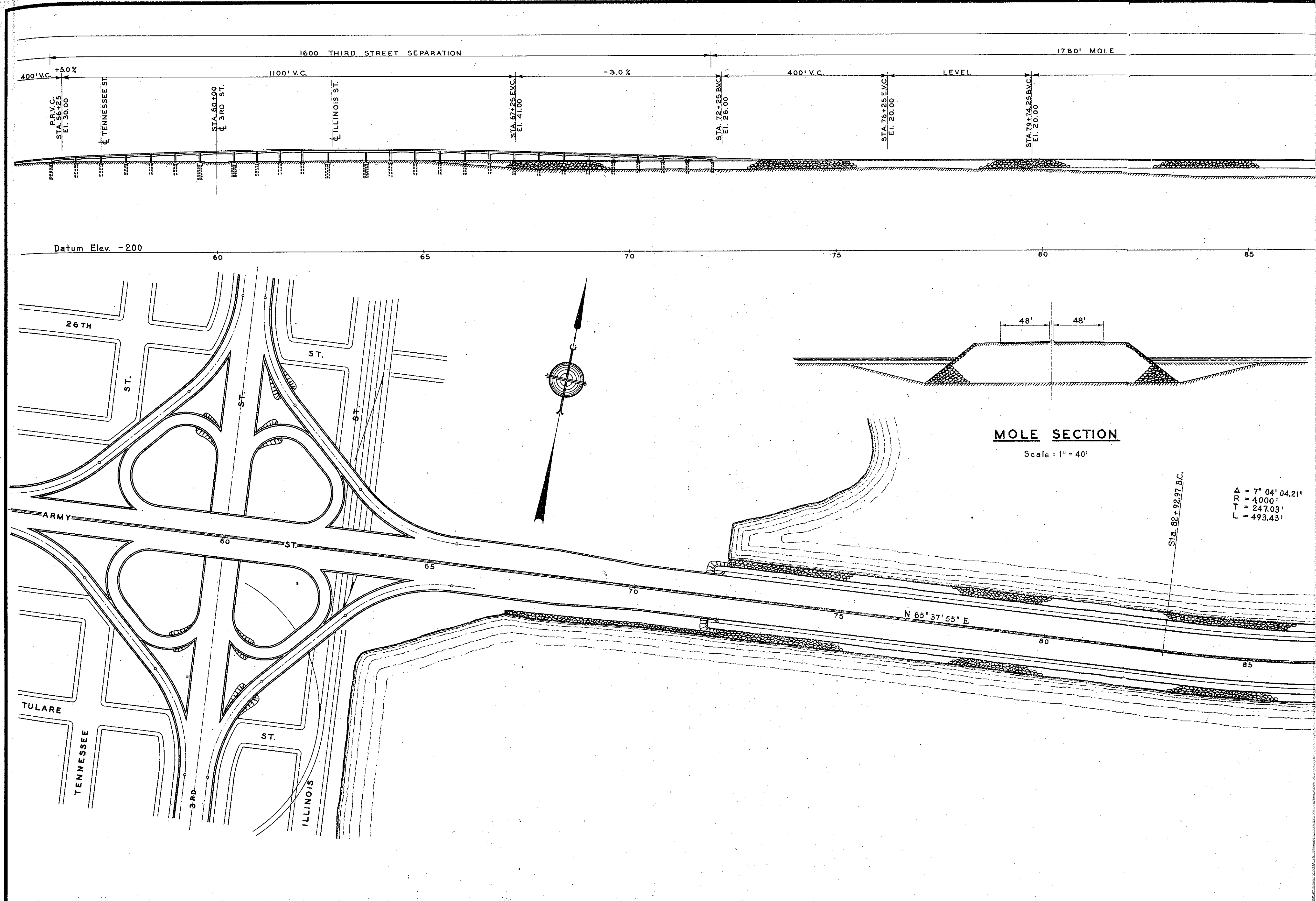
TRANS-BAY TUBE STUDY

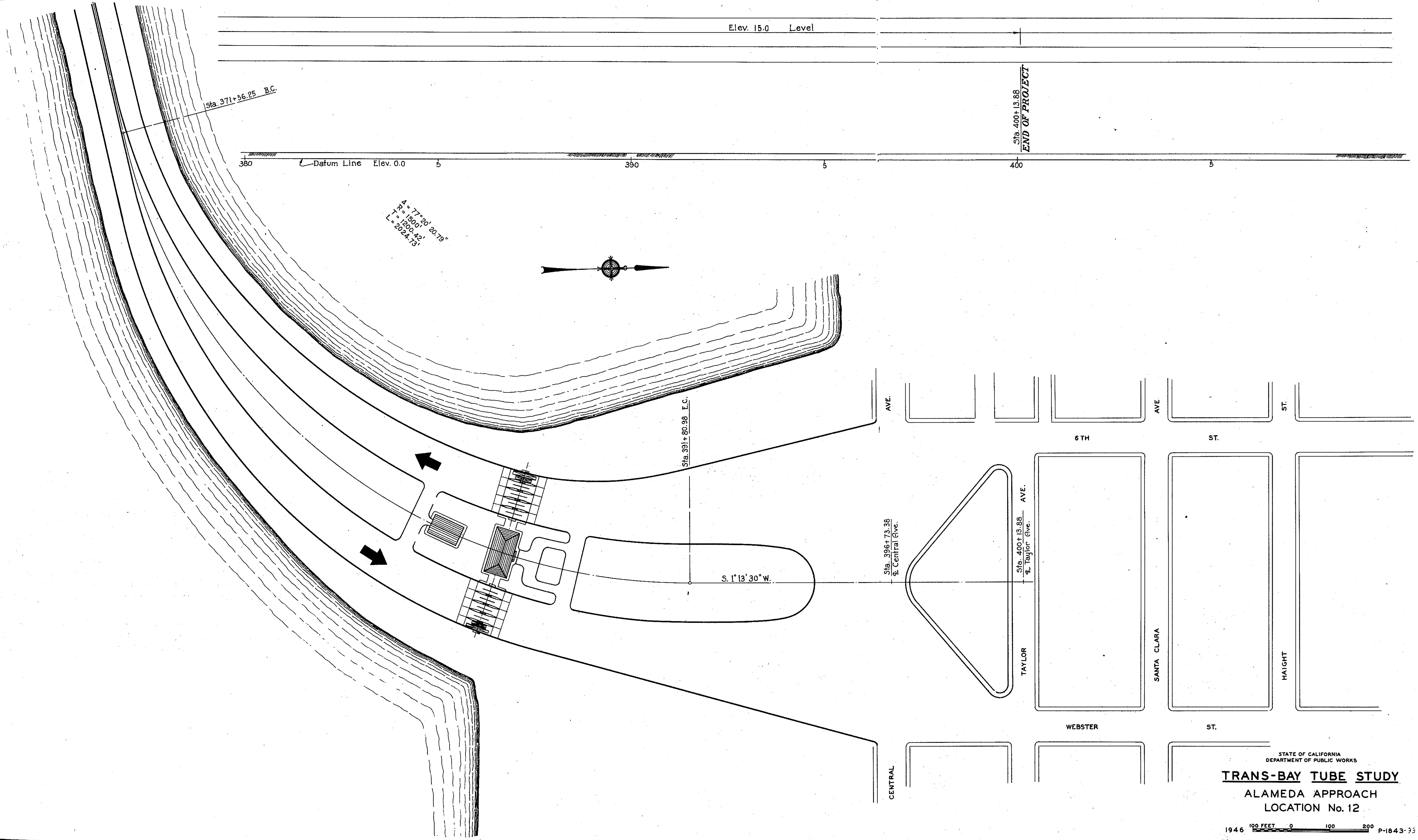
SAN FRANCISCO LAYOUT
LOCATION No. 12

SCALE IN FEET
100 0 100 200

1946 P-1843


1780' MOLE
1040' CAUSEWAY
-3.0 %
400' V.C.
LEVEL
4800' V.C.
STA. 67+25 E.V.C.
El. 41.00
STA. 72+25 B.V.C.
El. 26.00
STA. 76+25 E.V.C.
El. 20.00
STA. 79+74.25 B.V.C.
El. 20.00
STA. 89+80
STA. 100+20
70
75
80
85
90
95
100
ELEVATION
48'
48'
MOLE SECTION
Scale : 1" = 40'
50'
50'
CAUSEWAY SECTION
Scale : 1" = 40'
Sta. 82+92.97 B.C.
Δ = 7° 04' 04.21"
R = 4,000'
T = 247.03'
L = 493.43'
Sta. 87+86.40 E.C.
BULKHEAD LINE
PIERHEAD LINE
N 85° 37' 55" E
N 78° 33' 50.79" E
PLAN


1600' THIRD STREET SEPARATION
1780' MOLE
400' V.C.
+5.0%
1100' V.C.
-3.0%
400' V.C.
LEVEL
P.R.V.C. STA. 56+25 El. 30.00
℄ TENNESSEE ST.
STA. 60+00 ℄ 3RD ST.
℄ ILLINOIS ST.
STA. 67+25 E.V.C. El. 41.00
STA. 72+25 B.V.C. El. 26.00
STA. 76+25 E.V.C. El. 20.00
STA. 79+74.25 B.V.C. El. 20.00
Datum Elev. -200
60
65
70
75
80
85
26TH
ST.
ST.
ST.
ST.
ARMY
ST.
TULARE
ST.
TENNESSEE
3RD
ILLINOIS
N 85° 37' 55" E
48'
48'
MOLE SECTION
Scale: 1" = 40'
Sta. 82+92.97 B.C.
Δ = 7° 04' 04.21"
R = 4,000'
T = 247.03'
L = 493.43'

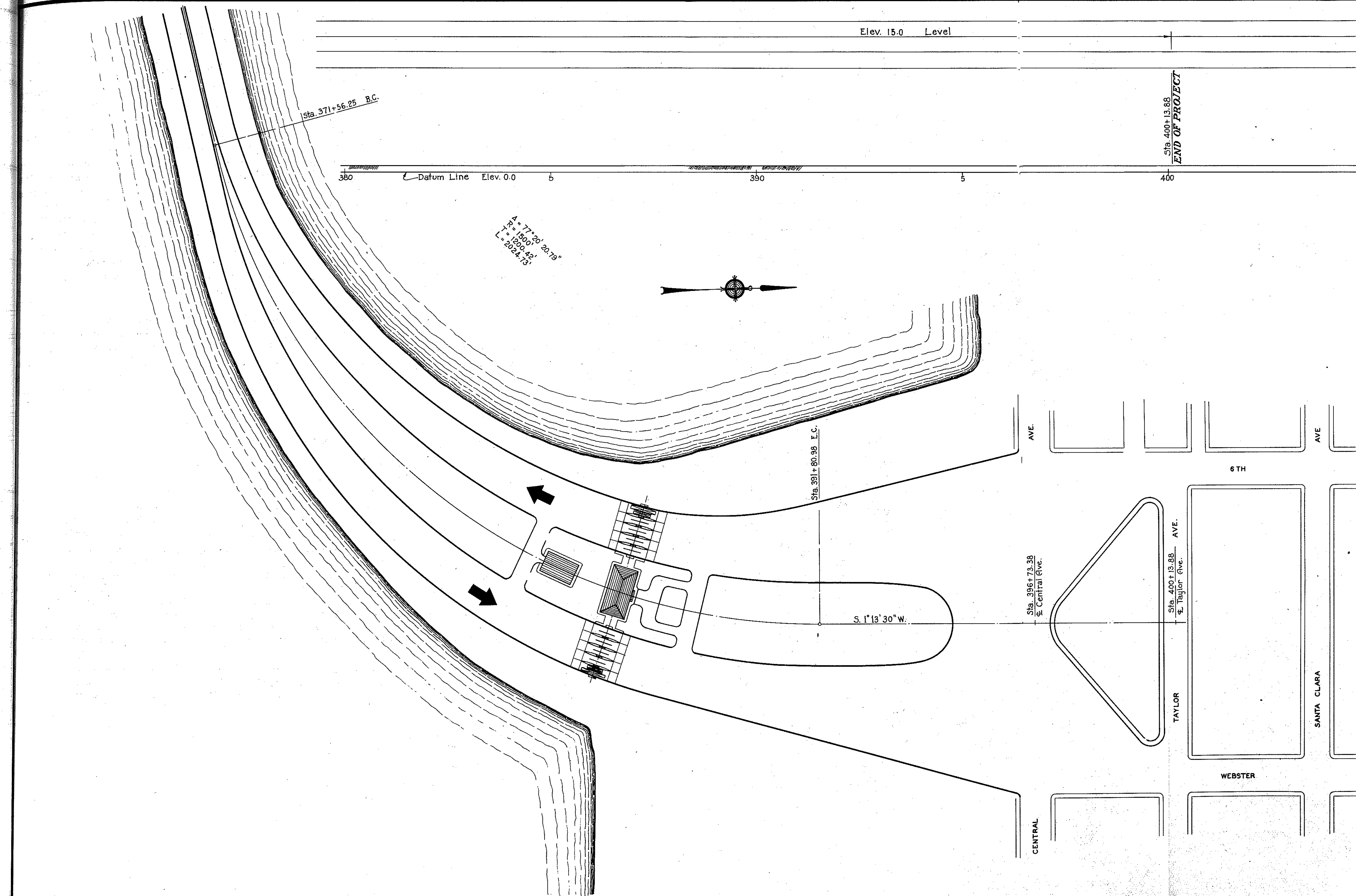


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

TRANS-BAY TUBE STUDY

ALAMEDA APPROACH
LOCATION No. 12

1946 100 FEET 0 100 200 P-1843-93


Elev. 15.0 Level
Sta. 400+13.88
END OF PROJECT
Sta. 371+56.25 B.C.
Datum Line Elev. 0.0
380
5
390
5
400
Δ = 77°20' 20.79"
R = 1500'
T = 1200.42'
L = 2024.73'
Sta. 391+80.98 E.C.
S. 1° 13' 30" W.
Sta. 396+73.38
℄ Central Ave.
Sta. 400+13.88
℄ Taylor Ave.
AVE.
6TH
AVE.
AVE.
CENTRAL
TAYLOR
SANTA CLARA
WEBSTER

through Alameda and Bay Farm Island offer opportunities for a greater dispersion. The physical features of the site do impose limitations on certain of these alignments.

There are really only four locations that are separate and distinct. The other proposals are modifications. The locations reported upon herein are as follows:

Plate V-76—Locations Nos. 2, 4, 7 and 8—vicinity of present San Francisco-Oakland Bay Bridge.

Plate V-77—Locations Nos. 3, 5 (tube), 6 and 9—Seventh and Peralta—Oakland.

Plate V-78—Location No. 10—Webster Street—Alameda.

Plate V-79—Location No. 11—Bay Farm Island—Alameda.

No other locations are reported upon nor is any recommendation made as to possible additional locations although certain modifications in alignment have been suggested for locations Nos. 10 and 11.

LOCATIONS NOS. 2, 4, 7 AND 8—SECOND BAY CROSSING

22nd Street—Stanford Avenue
San Francisco-Oakland Bay Bridge

SEE PLATE V-76

These plans recommend a bridge parallel with and in the vicinity of the San Francisco-Oakland Bay Bridge.

Location No. 2 is just north of the present San Francisco-Oakland Bay Bridge and crosses over the Eastshore Highway and Southern Pacific Railroad and enters Emeryville via Stanford Avenue. Cloverleaf connections are provided at the Eastshore Highway. Connections are provided from the San Francisco-Oakland Bay Bridge and the proposed Second Bay Bridge to 22d Street.

Location No. 4 proposes the construction of a bridge parallel and immediately south of the present San Francisco-Oakland Bay Bridge. This structure connects directly into 22d Street and does not provide for any interchange on the East Bay side. All interchange is to take place on Yerba Buena Island.

Locations Nos. 7 and 8 are practically identical and the necessary connections to the major street systems in the East Bay are the same. Locations Nos. 7 and 8 provide for a Second Bay Crossing parallel and immediately adjacent to the existing San Francisco-Oakland Bay Bridge. They also indicate distribution structures into the Eastshore Highway (northbound) and 22d Street.

The connections needed at this general location include:

(1) The improvement of Powell Street and Stanford Avenue from overpass at Southern Pacific Railroad to Ashby Avenue including a separation structure at San Pablo.
Land acquisition and improvement cost ---------- $3,750,000

(2) The widening and improvement of Ashby Avenue from the Eastshore Highway to Adeline Street.
Land acquisition and improvement cost ---------- 4,000,000

(3) The improvement of the Eastshore Highway from the proposed bridge head north to San Pablo including separation structure at Powell, Ashby, University, Buchanan and Gilman.
Land acquisition and improvement cost ---------- 18,000,000

(4) The redesign and reconstruction of the present San Francisco-Oakland Bay Bridge Distribution Structure.
Land acquisition and improvement cost ---------- 7,650,000

(5) Twenty-Second Street improvement from overpass at Cypress Street to San Pablo Avenue.
Land acquisition and improvement cost ---------- 3,500,000

(6) Widening MacArthur Boulevard from distribution structure to Barbara Road including separations at Broadway, Piedmont, Grand and Lakeshore.
Land acquisition and improvement cost ---------- 20,000,000

(7) The widening and improvement of Cypress Street from the present distribution structure to Seventh Street including separation structures at Seventh Street and 22d Street.
Land acquisition and improvement cost ---------- 7,000,000

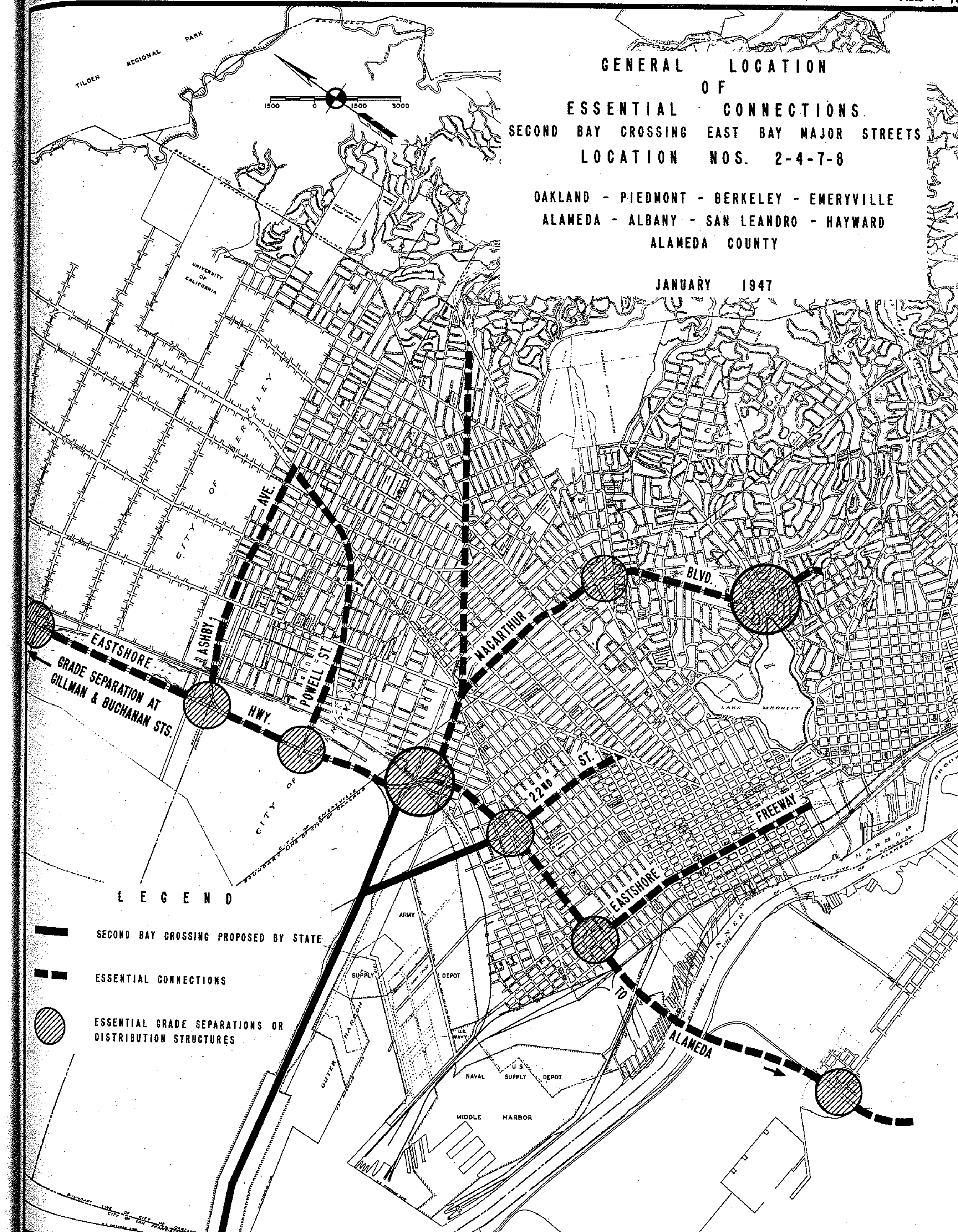
(8) A connection to Alameda from Seventh and Cypress Streets to Central Avenue at Fourth Street including a four-lane tube, grade separation at Atlantic Avenue, distribution structure at Pacific Avenue and the improvement of Main and Central Avenue.
Land acquisition and improvement cost ---------- 30,000,000

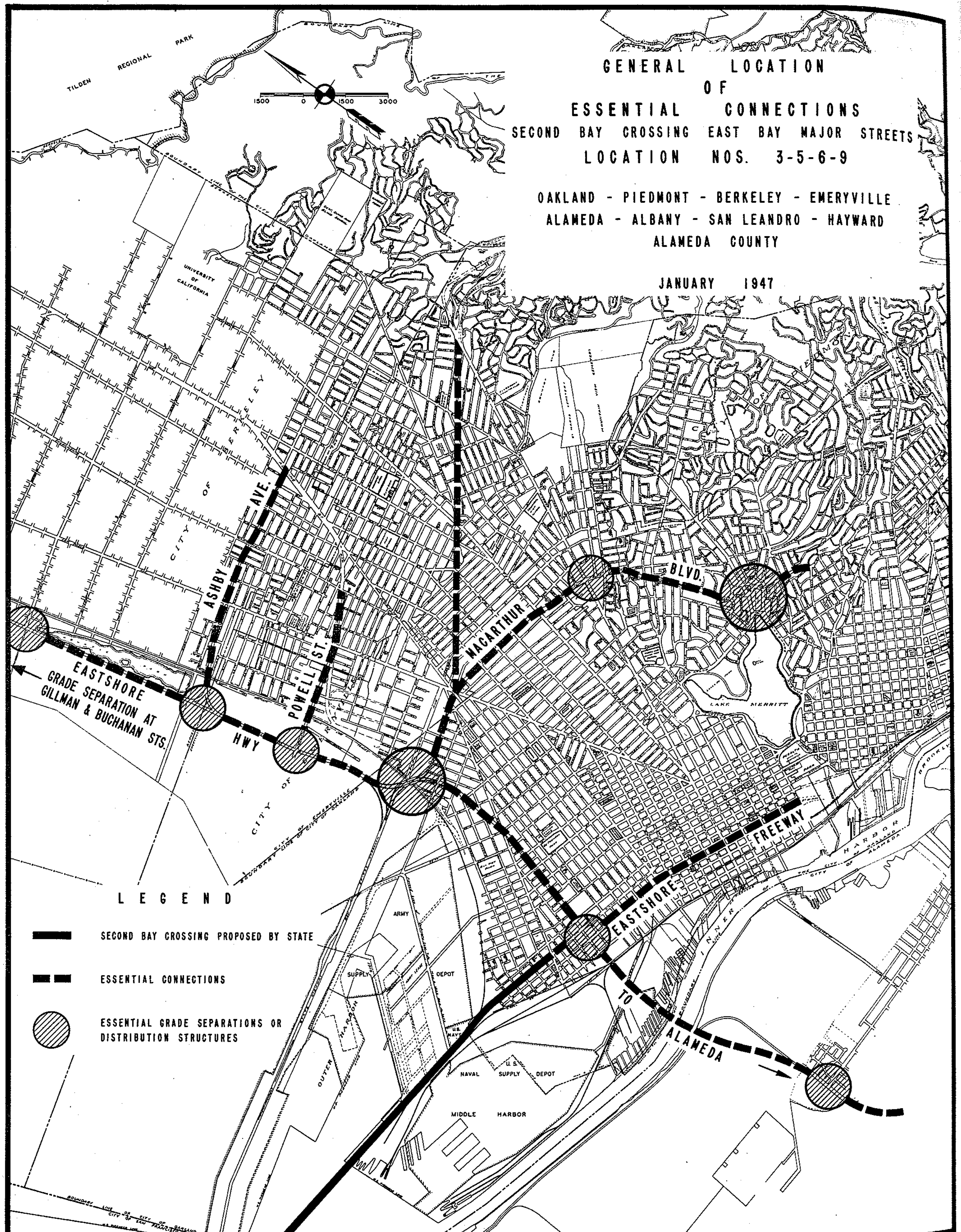
(9) A connection between the Eastshore Highway at Seventh and Cypress Streets to the Eastshore Freeway at Sixth and Fallon Streets.
Land acquisition and improvement cost ---------- 13,000,000

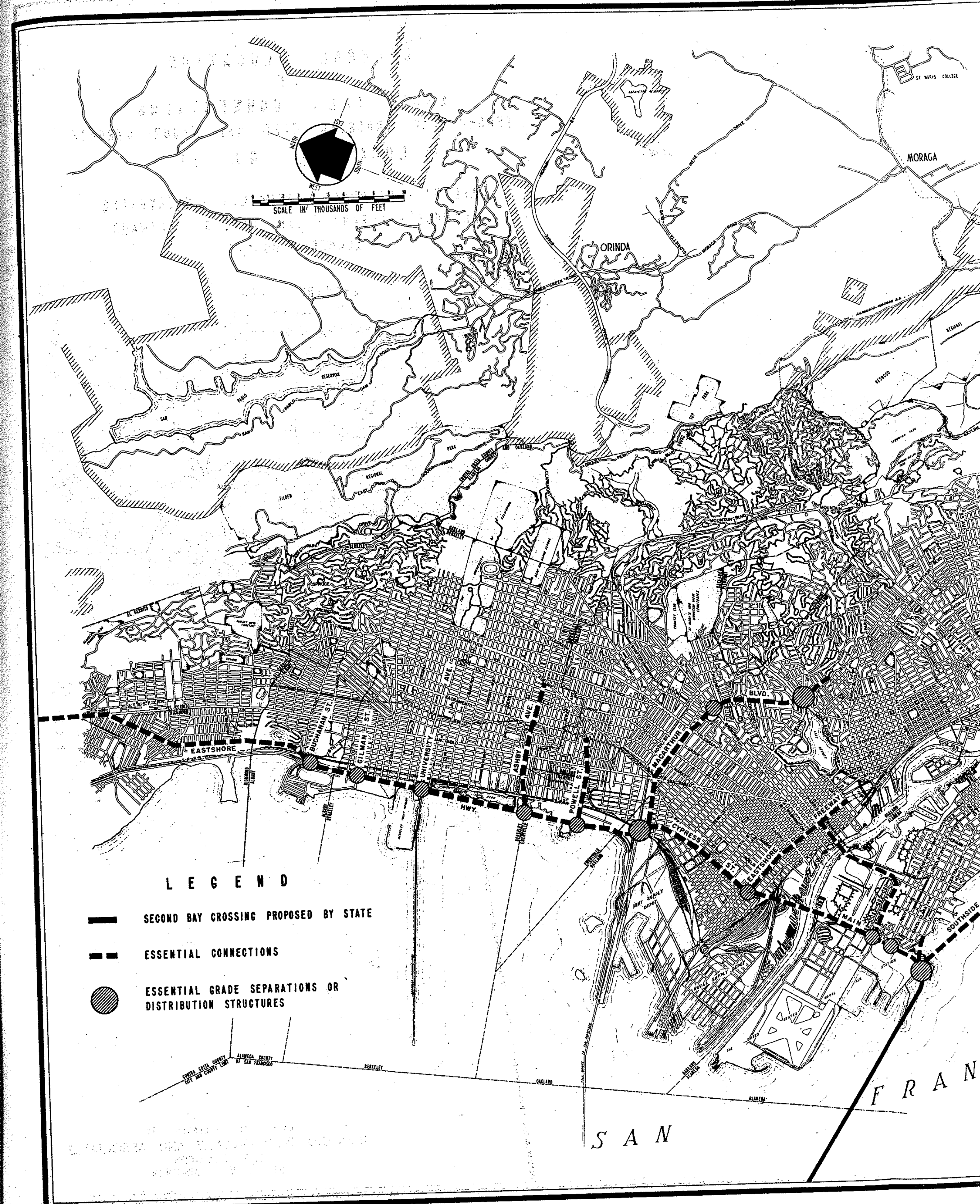
(10) Connection from MacArthur Boulevard to Tunnel Road.
Land acquisition and improvement cost ---------- 7,000,000

(11) TOTAL LAND ACQUISITION AND IMPROVEMENT COST ---------- $113,900,000

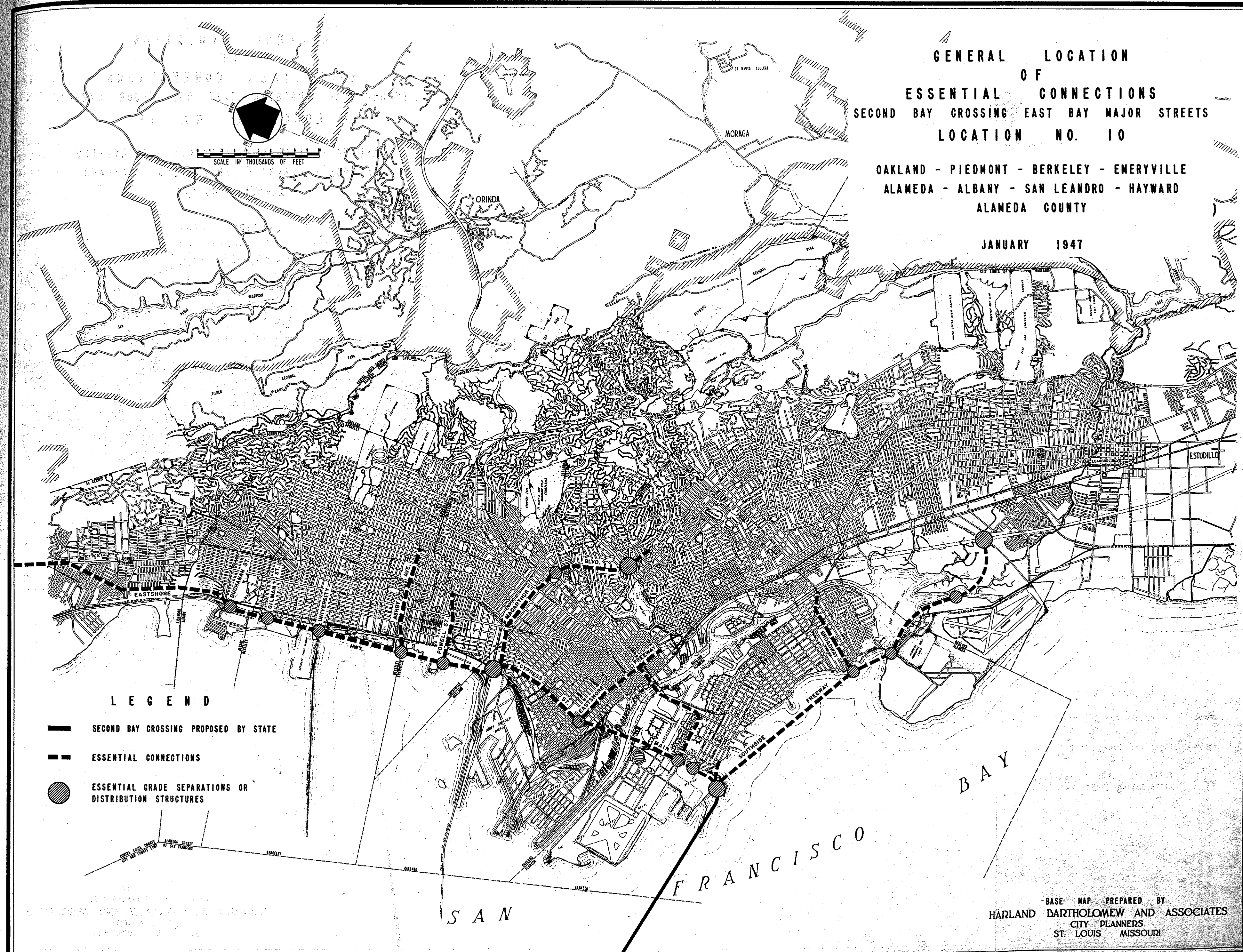
Plate V 76




GENERAL LOCATION
OF
ESSENTIAL CONNECTIONS
SECOND BAY CROSSING EAST BAY MAJOR STREETS
LOCATION NOS. 3-5-6-9
OAKLAND - PIEDMONT - BERKELEY - EMERYVILLE
ALAMEDA - ALBANY - SAN LEANDRO - HAYWARD
ALAMEDA COUNTY
JANUARY 1947
TILDEN REGIONAL PARK
UNIVERSITY OF CALIFORNIA
CITY OF BERKELEY
ASHBY AVE.
POWELL ST.
MACARTHUR
BLVD.
LAKE MERRITT
EASTSHORE
GRADE SEPARATION AT
GILLMAN & BUCHANAN STS.
HWY
CITY OF
EASTSHORE
FREEWAY
TO
ALAMEDA
ARMY
SUPPLY
DEPOT
NAVAL
U.S.
SUPPLY
DEPOT
MIDDLE
HARBOR
LEGEND
SECOND BAY CROSSING PROPOSED BY STATE
ESSENTIAL CONNECTIONS
ESSENTIAL GRADE SEPARATIONS OR
DISTRIBUTION STRUCTURES

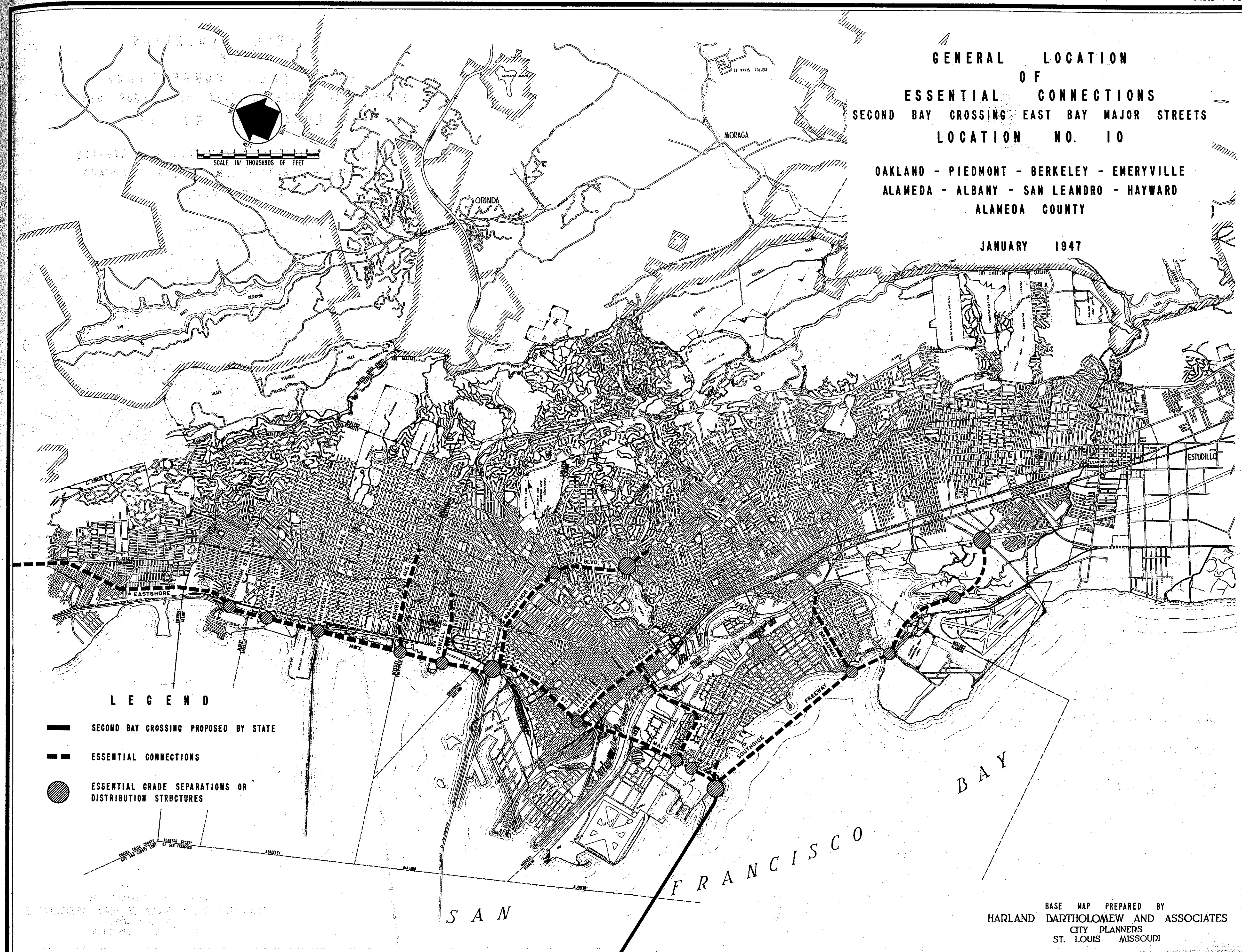

SCALE IN THOUSANDS OF FEET
ORINDA
MORAGA
ST MARYS COLLEGE
EASTSHORE
BUCHANAN ST.
GILMAN ST.
UNIVERSITY AVE.
ASHBY AVE.
HWY.
POWELL ST.
MACARTHUR
BLVD.
CYPRESS ST.
EASTSHORE
MAIN
SOUTHSIDE
LEGEND
SECOND BAY CROSSING PROPOSED BY STATE
ESSENTIAL CONNECTIONS
ESSENTIAL GRADE SEPARATIONS OR
DISTRIBUTION STRUCTURES
BERKELEY
OAKLAND
ALAMEDA
SAN
FRANC

GENERAL LOCATION
OF
ESSENTIAL CONNECTIONS
SECOND BAY CROSSING EAST BAY MAJOR STREETS
LOCATION NOS. 3-5-6-9
OAKLAND - PIEDMONT - BERKELEY - EMERYVILLE
ALAMEDA - ALBANY - SAN LEANDRO - HAYWARD
ALAMEDA COUNTY
JANUARY 1947
BLVD.
LAKE MERRITT
FREEWAY
EASTSHORE
TO ALAMEDA



GENERAL LOCATION
OF
ESSENTIAL CONNECTIONS
SECOND BAY CROSSING EAST BAY MAJOR STREETS
LOCATION NO. 10
OAKLAND - PIEDMONT - BERKELEY - EMERYVILLE
ALAMEDA - ALBANY - SAN LEANDRO - HAYWARD
ALAMEDA COUNTY
JANUARY 1947
SCALE IN THOUSANDS OF FEET
MORAGA
ORINDA
ESTUDILLO
EASTSHORE
HWY.
BLVD.
CYPRESS
FREEWAY
SOUTHSIDE
LEGEND
SECOND BAY CROSSING PROPOSED BY STATE
ESSENTIAL CONNECTIONS
ESSENTIAL GRADE SEPARATIONS OR DISTRIBUTION STRUCTURES
SAN FRANCISCO BAY
BASE MAP PREPARED BY
HARLAND BARTHOLOMEW AND ASSOCIATES
CITY PLANNERS
ST. LOUIS MISSOURI


GENERAL LOCATION
OF
ESSENTIAL CONNECTIONS
SECOND BAY CROSSING EAST BAY MAJOR STREETS
LOCATION NOS. 3-5-6-9
OAKLAND - PIEDMONT - BERKELEY - EMERYVILLE
ALAMEDA - ALBANY - SAN LEANDRO - HAYWARD
ALAMEDA COUNTY
JANUARY 1947
BLVD.
LAKE MERRITT
FREEWAY
EASTSHORE
ALAMEDA


GENERAL LOCATION
OF
ESSENTIAL CONNECTIONS
SECOND BAY CROSSING EAST BAY MAJOR STREETS
LOCATION NO. 10
OAKLAND - PIEDMONT - BERKELEY - EMERYVILLE
ALAMEDA - ALBANY - SAN LEANDRO - HAYWARD
ALAMEDA COUNTY
JANUARY 1947
SCALE IN THOUSANDS OF FEET
MORAGA
ORINDA
ESTUDILLO
EASTSHORE
BLVD.
HWY.
CYPRESS
SOUTHSIDE
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SECOND BAY CROSSING PROPOSED BY STATE
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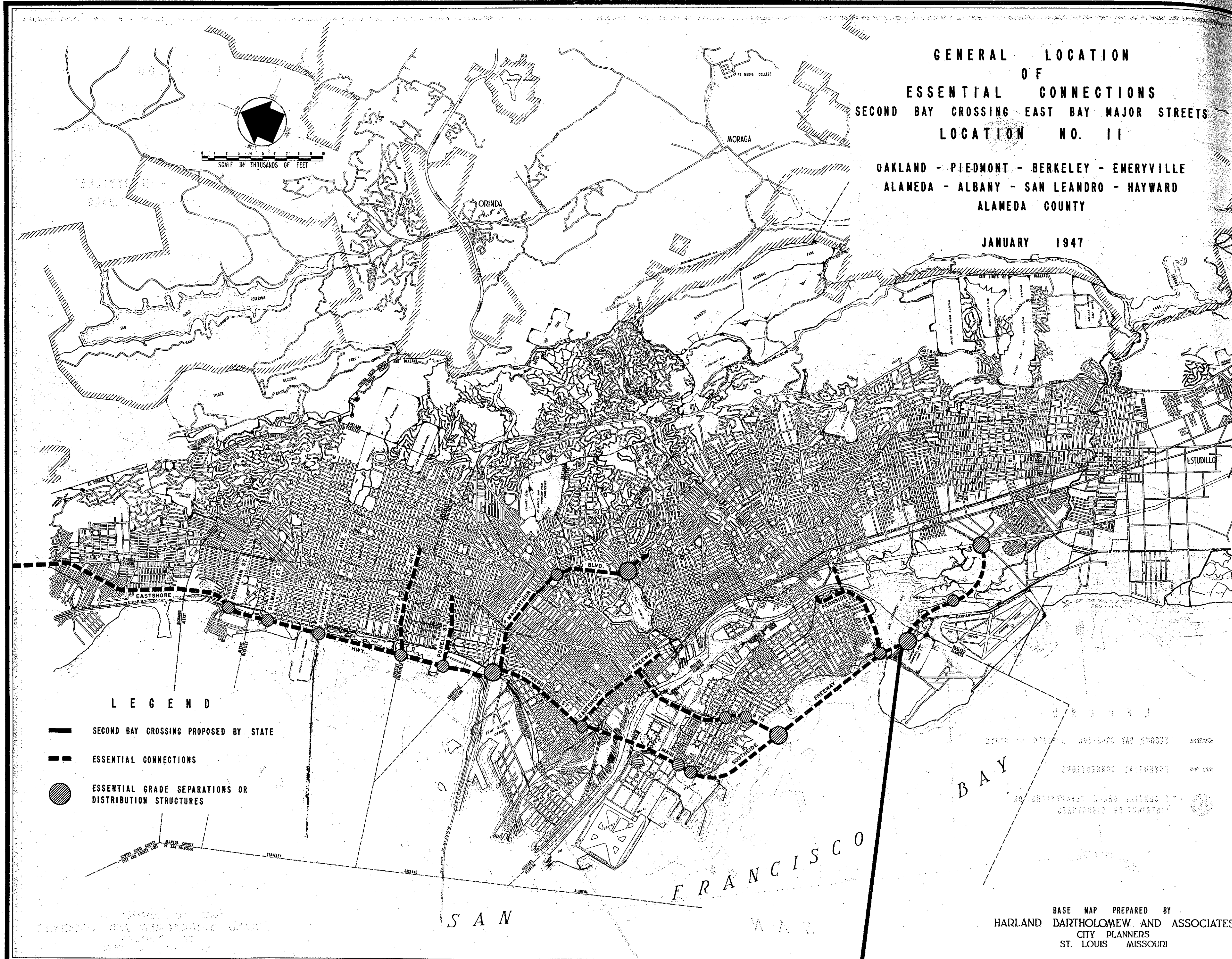

CATIONS NOS. 3, 5 (TUBE), 6 AND 9
COND BAY CROSSING

Seventh and Peralta Streets

SEE PLATE V-77

Included at this location are three bridge proposals and one tube. The bridge heads and tube portals are in approximately the same location and the necessary connections to the major street systems in the East Bay area are estimated to be the same for all structures. The extent of these facilities are indicated on Plate V-77. They include:

(1)	The improvement of Powell Street and Stanford Avenue from the Eastshore Highway to Sacramento Street. Land acquisition and improvement cost	$1,000,000
(2)	The widening and improvement of Ashby Avenue from the Eastshore Highway to Adeline Street. Land acquisition and improvement cost	4,000,000
(3)	The improvement of the Eastshore Highway from the San Francisco-Oakland Bay Bridge head north to San Pablo including separation structures at Powell, Ashby, University, Buchanan and Gilman. Land acquisition and improvement cost	18,000,000
(4)	The redesign and reconstruction of the San Francisco-Oakland Bay Bridge distribution structures. Land acquisition and improvement cost	7,650,000
(5)	Widening MacArthur Boulevard from distribution structure to Barbara Road including separations at Broadway, Piedmont, Grand and Lakeshore. Land acquisition and improvement cost	20,000,000
(6)	The widening and improvement of Cypress Street from the present distribution structure to Seventh Street including separation structures at Seventh Street. Land acquisition and improvement cost	6,000,000
(7)	A connection to Alameda from Seventh and Cypress to Central Avenue at Fourth Street, including a four-lane tube, grade separation at Atlantic distribution structure at Pacific Avenue and the improvement of Main Street and Central Avenue. Land acquisition and improvement cost	30,000,000
(8)	A connection between the Eastshore Highway at Seventh and Cypress Streets to the Eastshore Freeway at Sixth and Fallon Streets. Land acquisition and improvement cost	13,000,00
(9)	A connection from MacArthur Boulevard to Tunnel Road. Land acquisition and improvement cost	7,000,00
(10)	TOTAL LAND ACQUISITION AND IMPROVEMENT COST	$106,650,0

Report to the California Toll Bridge Authority

Covering Preliminary Studies

for an

Additional Bridge Between San Francisco and the East Bay Metropolitan Area

Calif.

BY DEPARTMENT OF PUBLIC WORKS

January 31, 1947

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